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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Extended Smoke Box for Burning Anthracite.

The use of extended smoke-boxes and straight stacks on locomotives for burning soft coal has become familiar to railroad mechanics, but their use for burning hard coal is not so well understood. We present herewith an engraving of the arrangement successfully adopted by Master Mechanic Woodcock, of the New Jersey Central division of the Reading Railroad. His experience with it is given in the following letter:

Editor American Machinist:

By request of your Mr. Hobart I send to you enclosed tracing showing our plan of extended smoke box, designed and used for burning anthracite coal. We have now over one hundred and fifty locomotives equipped and in service with this arrangement, all of which have worked very satisfactorily. The first engine was equipped for a trial in 1883, as I was in doubt as to its being made to work satisfactorily. After this engine had been in service for considerable time, and noticing its operation, I became convinced that it was worthy of further trial, and then commenced equipping our engines as rapidly as convenient.

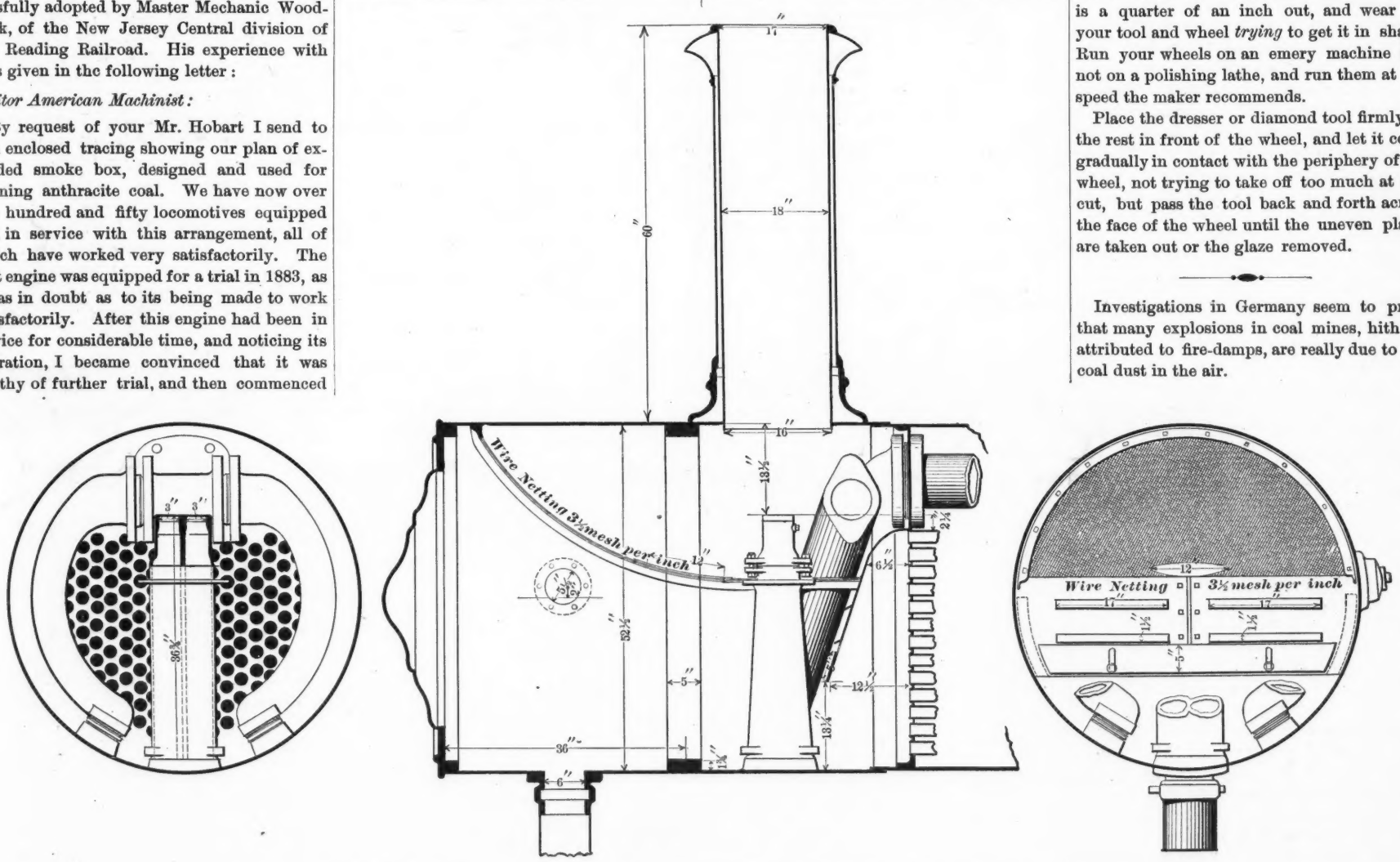
I find in the use of the arrangement we have a more steady and continuous draft on the fire, which is notsubjected to the sharp action of exhaust as is noticed in use of short exhaust pipe and with ordinary smoke box.

I think this modified draft is due to the action of the extended smoke box, which is similar to the action of the air-chamber on a pump, tending to make the draft more continuous; it is not subjected to the intermittent sharp action produced with short pipes. This arrangement I also think tends to more economical use of fuel, besides being a good spark arrester.

In the application of this device to old boilers it is absolutely necessary to make all joints and attachments air tight to insure good success in use of it.

The work must be solid and well done, and if done so no difficulty will, I think, be experienced, at least judging from the service our engines are subjected to running at high speed and hauling heavy freight trains, and noticing their working I am prepared to say it is giving good satisfaction. In the first application of this device I adopted the plan as shown in tracing, and all our engines have been thus equipped, having had no occasion to change or alter the plans.

WM. WOODCOCK, M. M.



SMOKE BOX EXTENSION AND SPARK ARRESTER—CYLINDERS 19″ × 24″. READING RAILROAD.

See that no shaft-spindle or journal has too much end motion. Excessive end-motion leads to excessive wear, and rapidly depreciates the efficiency of a machine.

How to True Emery Wheels.

BY L. BEST.

At different times articles have appeared giving information about turning and truing emery wheels when out of balance, but they are usually written by those who have had experience with wheels of only one class (while there are over thirty different varieties manufactured), so that the methods practiced in one shop would be of very little practical value in another where wheels of a different make are used.

Having had a long practical experience in adapting emery wheels and corundum wheels to all classes of work, and observing their condition after weeks and months of use and misuse, both as regards actual grinding and attempts to true them, I feel that a statement of what this experience has taught me will be appreciated by the users of wheels who wish to keep them in proper condition and get as much service from them as possible.

At the start let it be thoroughly understood that an emery wheel is one of the most abused and neglected tools in use, especially in some machine shops, where they are allowed to run on spindles sprung out of line, boxes worn out, machines much too light for the purpose, without rests on which to hold the work or turning tool, and, to make matters still worse, the emery machine is placed in some dark corner of the shop upon an improper foundation, and at the same time the wheels are expected to grind all kinds of metals, from the bar of tool steel and soft brass to chilled iron and tempered tools, and if with this gentle usage it gets out of true or glazed over, the unlucky manufacturer is expected to replace it free of charge.

Emery wheels may be divided into two general classes, with some variations: First, wheels pressed together and having the grains of emery held together by a gummy material, which are to be run at a high rate of speed to burn out the bond, thus exposing the emery and causing it to cut; second, those made by mixing the emery or corundum with another mineral, and when moulded into shape brought in contact with heat which melts or fluxes the bond, thus holding together the grains of emery and producing a porous wheel, which need not be run at a high rate of speed, as no bond is to be burned out.

In turning a wheel described in class one, always use a diamond tool, as a dresser will not answer, but on wheels of class two use the dresser on all square-face wheels and the diamond on wheels with bevel and round faces. The diamond is almost altogether useless on the hard grades of porous or burned wheels, and leaves the surface dull. The proper time to true up a wheel is when you can scarcely see it is out of true; keep the dresser or diamond tool handy, and use it often, thus saving both the wheel and tool. Allow only one man to do the truing, and let him be one who understands what he is doing (leaving the experimenting to the party who sells you the tool), for the carbon is easily lost out of the setting, and once lost is seldom found. Do not wait until the wheel is a quarter of an inch out, and wear out your tool and wheel *trying* to get it in shape. Run your wheels on an emery machine and not on a polishing lathe, and run them at the speed the maker recommends.

Place the dresser or diamond tool firmly on the rest in front of the wheel, and let it come gradually in contact with the periphery of the wheel, not trying to take off too much at one cut, but pass the tool back and forth across the face of the wheel until the uneven places are taken out or the glaze removed.

Investigations in Germany seem to prove that many explosions in coal mines, hitherto attributed to fire-damps, are really due to fine coal dust in the air.

In a furnace, in an iron and steel works, banked and hermetically sealed, the fire was found in good condition after sixteen months.

An engineer's communication to a mechanical journal published in the East asks for information in regard to the performance of his steam plant. He is running eleven hours a day and makes fifty barrels of flour, and uses 2,400 pounds of Ohio nut and slack coal. The editor of the journal in question, in answer to this communication, says that the engineer ought to be able to get along with thirty pounds of coal per barrel of flour, if he were to run twenty-four hours. This would be 1,800 pounds of coal as against 2,400, which would represent forty-eight pounds per barrel in this mill. Thirty pounds of coal per barrel is a great deal less than is required by most of the mills in this country to make a barrel of flour. There are a great many Corliss engines running flour mills where they have a fairly good boiler plant, which require the use of more coal than this. Forty-eight pounds of coal per barrel is below the average for slide-valve engines. It would take a very good boiler plant and one of the best

engines made to get as low as thirty pounds per barrel. We know that there are steam plants in use that are making a barrel of flour out of less than twenty pounds of coal, but these are very exceptional cases, where they have the highest type of boilers, first-class engines with compound cylinders and condenser attachment.—*The Millstone*

Strength of Different Mixtures of Cast-Iron and Method of Testing.

BY ROBERT E. MASTERS.

[*Reprinted from our issue of March 27, 1886, the demand for extra copies of that issue containing this article, having exhausted our reserve stock available for that purpose.*]

"Honor to whom honor is due." William Merrill, in the AMERICAN MACHINIST, February 6th, 1886, gives an account of a "cheap testing machine," which is so simple and inexpensive that I concluded to make one on the same plan, and I am highly pleased with it. Although the description given by Mr. Merrill is very clear, there are many who would understand it more readily from an illustration, and see the value of testing the strength of different mixtures of iron used, when they can do so with very little labor and at a trifling expense.

In the article referred to, Mr. Merrill states that he "drilled a $\frac{3}{4}$" hole through the center of the platform of the scale, and had the nut on top of the platform." Our scale like the majority of scales, has a wooden platform set in an iron frame. As I knew the platform would not stand the pressure when testing a bar, I made a cast-iron brace, Fig. 1, 3" wide, $1\frac{1}{4}$" thick in the center, and tapered to $\frac{3}{4}$" thick at the ends; through the center of this I cored a $\frac{3}{4}$" hole. This bar I made long enough to reach across the scale, and rest on the iron frame to give a solid bearing and protect the platform, as seen at *A*, Fig. 2. After boring a hole, the eye-bolt of $\frac{5}{8}$" iron, Fig. 3, is put through the hole in the plat form and brace bar from underneath, and the bar to be tested is put through the eye of the bolt and screwed up until it rests against the under part of the frame of the scales, shown at *B B*, Fig. 2. The wrench, Fig. 4, is then put on at *C*, and the eye-bolt screwed up, weights being added and the poise carefully moved out on the scale beam until the bar is broken.

This may be considered as rather a crude way of testing the transverse breaking pressure of cast-iron mixtures. But when the iron is melted, the test bars made and tested under the same conditions, it is as fair for one brand of iron as it is for another. The firm I am connected with, use over 1,000 tons of pig iron per annum; their castings are required to be strong and soft, and, as there are but very few castings made in the foundry but what some work is required on in the machine shop, the "heat" can be made of the same mixture all through.

Every agent for foundry iron that I have talked to yet, represents a firm that sells a little stronger or a little softer iron than any other firm. To put this question beyond a doubt, before ordering the iron for this season's work, we concluded to make tests on some of the most popular brands of soft and hard irons used through this section of the country.

It may be thought by some that the iron in the charges, other than that of which I expected to make my test bars, in melting might have got mixed with the charge of which I made the test bars, thereby changing its nature; there is no trouble in melting a charge separately, but to obtain correct figures on the different mixtures, without taking any chances, I made a separate heat of 12,000 pounds in charges of 1,200 pounds of each of the mixtures given below, using the same kind and same amount of fuel at each heat. From each mixture I made three test bars 2' 6" long and 1" square. In moulding them, the pattern was drawn from the sand without sponging, the mouth gated with a skim gate at one end and flowed through at the other end, and poured at stated intervals during each heat.

The inside measure of the frame of our scale is $23\frac{1}{2}$". To give 24" between points of bearing, I made two triangular-shaped castings 1" deep from point to base and 4" long; these I placed between the frame of the scale and the bar to be tested, as shown at *B B*, Fig. 2. Before testing, each bar was dressed as nearly 1" square as we could get it. The test bar, triangular-shaped blocks, wrench and all, were laid on the scales and the weight taken. In making the tests, a steady pull was given on the end of the wrought-iron wrench, and, after 900 pounds had been raised, the poise was moved out two pounds at a time until 1,000 pounds was reached, when, if the bar had not broken, a 100-pound weight was added and the poise placed back, to be moved out again two pounds at a time, and continued in like manner until the bar was broken.

I first tried, for the relative strengths of the soft iron; the following are the mixtures and result of tests:

TEST NO. 1.

$\frac{1}{3}$ Warners' Am. Scotch. $\frac{1}{3}$ Sauk. $\frac{1}{6}$ National. $\frac{1}{6}$ Scrap.	Broke at 915 lbs. Shrinkage, $\frac{9}{64}$" to 1'. Grain, very close.

TEST NO. 2.

$\frac{1}{3}$ Hazelton. $\frac{1}{3}$ Sauk. $\frac{1}{6}$ National. $\frac{1}{6}$ Scrap.	Broke at 1,105 lbs. Shrinkage, $\frac{1}{8}$" to 1'. Grain, open.

TEST NO. 3.

$\frac{1}{3}$ Dexter. $\frac{1}{3}$ Sauk. $\frac{1}{6}$ National. $\frac{1}{6}$ Scrap.	Broke at 1,151 lbs. Shrinkage, $\frac{9}{64}$" to 1'. Grain, close and hard at edge of bar.

TEST NO. 4.

$\frac{1}{3}$ Wellston. $\frac{1}{3}$ Sauk. $\frac{1}{6}$ National. $\frac{1}{6}$ Scrap.	Broke at 1,212 lbs. Shrinkage, $\frac{7}{64}$" to 1'. Grain, close.

TEST NO. 5.

$\frac{1}{3}$ Norway. $\frac{1}{3}$ Sauk. $\frac{1}{6}$ National. $\frac{1}{6}$ Scrap.	Broke at 1,325 lbs. Shrinkage, $\frac{1}{8}$" to 1'. Grain, fine and even all through.

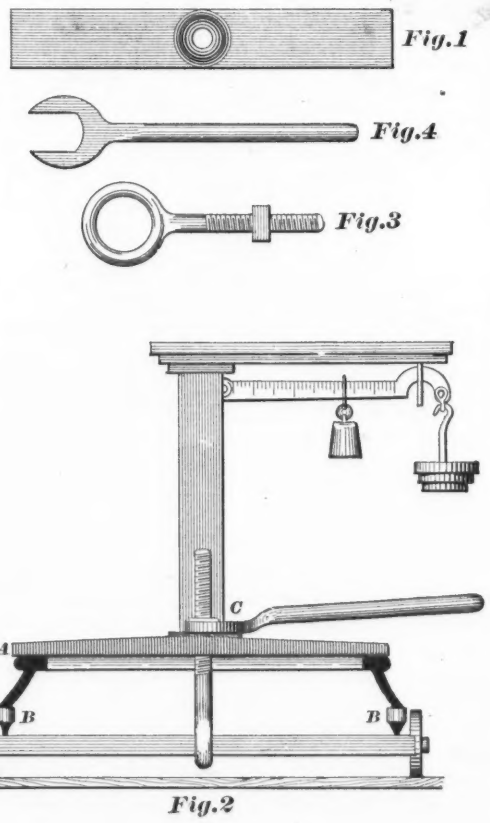


Fig. 1

Fig. 4

Fig. 3

Fig. 2

"Warners," "Hazelton," "Dexter," and "Wellston," are all Ohio soft iron. Norway is a Pennsylvania soft iron. It will be noticed in the list of tests, that the mixtures are the same all through each heat, with the exception of changing the soft iron in each heat. The Sauk iron mentioned in each test is a No. 1 charcoal hard iron from native interior Wisconsin ore.

I then tried to compare the strength of some of the hard irons that we use, and obtained the following:

TEST NO 6.

$\frac{1}{3}$ Hazelton. $\frac{1}{3}$ National. $\frac{1}{3}$ Scrap.	Broke at 945 lbs. Shrinkage, $\frac{9}{64}$" to 1.' Grain, fine in center and close at edge.

TEST NO. 7.

$\frac{1}{3}$ Hazelton. $\frac{1}{3}$ Sauk. $\frac{1}{3}$ Scrap.	Broke at 1,130 lbs. Shrinkage, $\frac{1}{8}$" to 1'. Grain, very fine and even.

TEST NO. 8.

$\frac{1}{3}$ Hazelton. $\frac{1}{3}$ Union Bessemer. $\frac{1}{3}$ Scrap.	Broke at 1,283 lbs. Shrinkage, $\frac{1}{8}$" to 1'. Grain, coarse and open all through.

It will be seen that I used the same soft iron through all of these latter tests, changing the hard iron in each heat. Tests that I have made on the "Appleton," "Depere," and other well-known brands of Lake Superior hard iron, rate with the "National" which is also a Lake Superior hard iron. The "Union Bessemer" is a hard iron composed mostly of Lake Superior ore, the pig is produced in Illinois.

Taking the figures shown in the tests 5, 7 and 8, I concluded to use a mixture of equal parts of Scrap and the irons from which I had obtained the best results, and made

TEST NO. 9.

$\frac{1}{4}$ Norway $\frac{1}{4}$ Union Bessemer. $\frac{1}{4}$ Sauk. $\frac{1}{4}$ Scrap.	Broke at 1,362 lbs. Shrinkage, $\frac{1}{8}$" to 1'. Grain, rather close and even.

The scrap we used in all these tests was an even grade of selected machine scrap. The figures given are the average of tests obtained from three bars of each kind, and I noticed that each set of bars, of any of these mixtures, broke within a few pounds of each other.

Tapping Holes in Boilers.

BY A. B. LANDIS.

The accompanying cut represents a drawing of a device I made several years ago for tapping gauge-cock and water-gauge holes in the fronts of portable and traction engine boilers. What led to a device for this purpose was the extreme annoyance of having the holes tapped out of square with the head, and consequently not parallel with each other, as is very important in the case of a water-gauge, in order to make a good connection or packing to the glass tube without causing strain on the tube, and consequent danger of breaking it, and, further, it avoids the unsightly appearance of holes thus tapped.

As a rule, unskilled labor is employed on this class of work; therefore, the liability, as above, is great. Often, when a hole is started tapping, the tap, having entered a short distance, is found to be out of square, and therefore, in order to try to straighten it, the tap is drawn to one side, frequently causing a bad thread (especially if not done soon enough), tearing the threads from the tap and soon making it unfit for use.

My experience with this work was that we continually had bad work (by the unskilled workmen), and a continuous job replacing taps. As a remedy, I adopted the plan shown in the drawings, since which time we have had square-tapped holes, good threads, and taps which last about ten or more times as long as formerly. By this process also two to three holes can be tapped where one was tapped before; consequently the economy is apparent.

The drawings are plain, and I think self-explanatory. Fig. 1 shows a portion of the front of a fire-box boiler, and Fig. 2 a top view of the same. A hand-hole is nearly always in this sheet, and this I use, through which to fasten my device. *A* is a casting, with a flange base to cover the hand-hole; it has a bearing, upon which is a sleeve *B*, with a flat flanged side, which is planed out, dove-tailed-shape, to receive bar *C*, which is a sliding fit.

One end of this bar has a boss or sleeve bored square with the bar, which receives the

Fig. 2

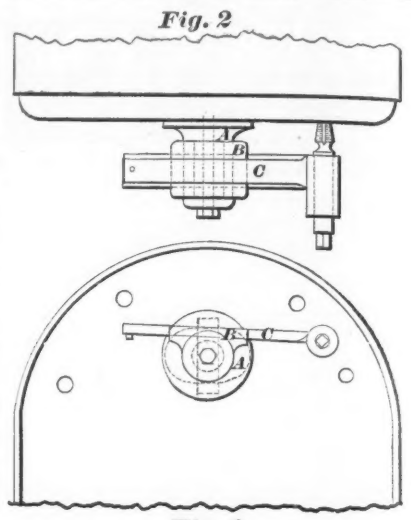


Fig. 1

TAPPING HOLES IN BOILERS.

shank of the tap, which is made something larger than the tap in order to slide it through from the outside. The casting I fasten to the boiler by a bolt, with a cross-bar inside the boiler across the hand-hole. Now it will be seen that any hole can be reached by this arrangement by swinging it on the bearing, and sliding the bar *C* back and forth, and that all holes thus tapped must be practically parallel with each other.

This device might be as applicable to other tapping purposes as to this, but for this purpose it has proved very valuable, and has many times paid its cost.

It has been stated that the attempt to use coke in a pig-iron furnace, without the admixture of other fuel, proved a failure.

Master Mechanics Seeking Information for Reports.

Four of the committees of the American Railway Master Mechanics' Association have sent out circulars to obtain information upon which to base their reports to the next annual convention, which meets in Boston, third Tuesday in June. The circulars are as follows:

To the Members of the American Railway Master Mechanics Association:

GENTLEMEN: The undersigned have been appointed a committee on "Standard Driving Wheel Centers and Standard Section of Tires," and respectfully solicit answers to the following questions:

FIRST: What are the standard sizes of driving wheel centers in use on your road for the different classes of engines, or, if no standard has been adopted, what are the sizes generally in use?

SECOND: What thickness of driving wheel tires are you using for the different classes of engines on your road?

THIRD: Please send your replies, before April 15, 1886, to J. N. Lauder, superintendent Rolling Stock, O. C. R. R., Boston, Mass.

Respectfully,
J. N. LAUDER,
J. JOHANN,
H. N. SPRAGUE,
Committee.

DEAR SIR: The Committee on Improvement of Locomotive Boiler Construction respectfully request such general information as you can give of the art and particularly to that of improvements (however minute a nature), and to those of a character that permit a higher steam pressure to be carried, and to first cost and maintenance of the Wootton boiler or boilers of similar or any design in comparison with those of usual type.

Drawings should be sent, illustrating improvements, and communications as regards the whole or part of the subject under consideration will receive attention.

GEO. W. STEVENS,
WM. FULLER,
T. J. HATSWELL,
Committee.

Replies should be addressed not later than

April 1, 1886, to G. W. Stevens, Supt. M. P., L. S. & M. S. Ry., Cleveland, O.

The Committee on Shop Tools respectfully ask for the following information:

Please state if you have used milling machines instead of planers for surfacing work. State kind of work surfaced and difference in time in favor of either machine.

It is not necessary to give the number of hours occupied by a machine in performing a certain amount of work. The result, if given in form of a percentage in favor of the one or the other machine, will answer quite as well, the object being to simply ascertain which is the cheaper method, and to what extent.

If you have anything to suggest in the matter, I shall be pleased to have you do so.

Yours truly,
D. A. WIGHTMAN,
Supt. Pittsburgh Locomotive Works,
Pittsburgh, Pa.

The Balanced Slide Valve Committee request an early reply to the following questions:

1. With what balanced slide valves for locomotives have you had experience? Please send sketch or drawing of same.

2. Upon how many machines were these valves applied? Give date when the first of each description was placed in service.

3. If you have had experience with more than one kind of balanced slide valves, please state which you consider on the whole the most satisfactory, and name the good and bad features of each valve.

4. What is the cost of these balanced valves and necessary adjuncts, per engine, compared with the ordinary valve?

5. What is the average cost per engine per annum of maintaining these balanced valves and their seats? Give figures applicable to each twelve months after valves were placed in service, until their renewal was required; give similar figures in the case of ordinary valves on the same class of engine, and if possible, mileage made each year.

6. What mileage is represented by one-quarter inch wear of valve seats of similar engines, when using and when not using the balanced valves, and state if vacuum valves were used in each case on steam chests?

7. When packing strips are used, what width should they be to give the best results? Should they and the grooves in valve be fitted by scraping, or will planer and milling machine make a sufficiently good finish?

8. When springs for holding up the packing strips are used, what kind give best results?

9. What increased life of valve gear is obtained by using balanced valves? Does it thereby reduce the cost of engine repairs to an appreciable extent?

Do not confine your answer to the above question, but please give any information, statistics or opinion you may have on the general subject of balanced slide valves for locomotive use.

CHARLES BLACKWELL,
E. M. ROBERTS,
JAMES MEEHAN,
Committee.

Replies to be addressed to
CHARLES BLACKWELL,
Roanoke, Va.

An inventor has patented an apparatus fo making extracts. If this applies to scissors extracts in newspaper work, we hope it will be amended so as to cover giving due credit.

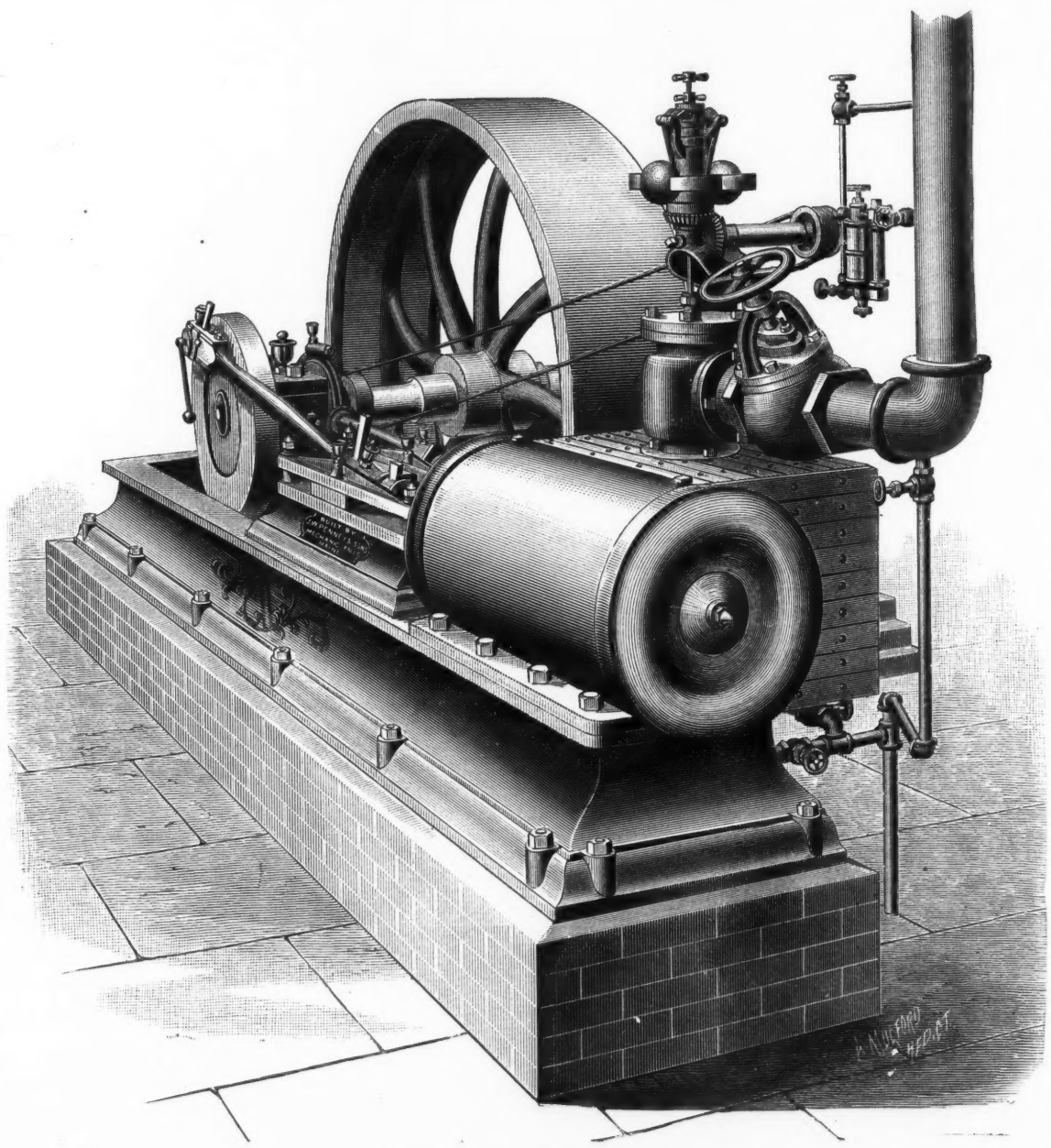
Railroad Shop Matters in Chicago.

The car and locomotive shops of the Chicago, Rock Island and Pacific Railroad in Chicago, employ about 900 men nine hours a day. They do not only repair work but build their own locomotives. When we called at the shops last week they had just started to build six 18″x24″ engines with 5½ foot drivers. We noticed particularly the boilers under construction. Each is 56″ diameter and of steel throughout, with 184 two-inch tubes. Shell is half inch thick. The fire-box shell is made from a single sheet that extends from mud ring to mud ring. The crown sheet is arched and is supported by radial stay bolts screwed into the outside shell. The dome is placed on the cylindrical part of the boiler in front of the fire-box. The boilers are calculated to carry 150 pounds of steam. The practice on this road is to paint side rods and most other exposed parts of engines that are usually bright finished on other roads. Steel castings are largely used, especially for cross-heads, rocker-shafts, and link-hangers. Master Mechanic Twombly believes in using materials giving the greatest strength and durability. Several locomotives were being repaired, among them one of R. L. Walker's patent, which was noticed in our columns some months ago. Its peculiarity is entirely in the furnace, which is divided into two parts by a longitudinal partition. The upper part of the partition is a damper, which swings both ways, so as to carry the draft to either side as desired. The firing is done alternately, the draft from the freshly fed coal passing over the older fire and causing, it is claimed, a complete combustion of the gases. In the course of several months use trials of economy have been made against a regular freight engine, resulting rather in favor of the latter. The Walker engine, however, throws out fewer sparks and cinders. The tool room seems to be well kept, but the tools are not placed upon numbered shelves, nor is the brass check system followed. The keeper of the tool-room marks down the tools given to each man but keeps only a mental record of the arrangements inside the room.

Work is slack at the shops of the Illinois Central Railroad in Chicago, and a number of men have been laid off lately. The locomotive shops now employ but 300 men, and the car shops 450 men nine hours a day. The machine shops are quite old, and machines are placed about as closely together as it is possible to work them. New shops are much needed, but will probably not be built as long as business remains dull. At the time of our visit, a week ago, they were just starting to build ten fifty-ton mogul freight locomotives with 18″x24″ cylinders. The boilers will be 56″ diameter, with 211 tubes. They are of the wagon-box type. These shops also have under way three double-ender engines for suburban trains. They will have 16″x22″ cylinders and 50″ straight boilers of $\frac{7}{16}$ inch steel, and with 145 tubes each. Each engine has swinging trucks. This road now runs 68 suburban trains, and will increase the number to 84 on the first of May.

The Illinois Central now uses 346 locomotives of which between 80 and 90 have been built in their own shops. Some 130 have been acquired by lease. About 25 engines will be rebuilt this year. They claim to be able to build better and cheaper locomotives than they can buy. We noticed in the round-house an engine built in 1854, which is still in service, and one built in 1853, which still has its original boiler. The latter has just been repaired about $600 worth and sold to another road. They have several engines that have been running since 1854 with the original boilers and frames. One of their locomotives (built at the Rogers works) ran 1,200,000 miles during its whole time of service. We saw in the round-house several engines that were built in 1863 and 1864 that are in use and in good condition.

No pumps are used on the engines of this road. Feeding is wholly done by injectors. Extension smoke-boxes and straight stacks are being placed upon all new engines. All the double-ender engines have these improvements. On some of the locomotives of this line the dome of the boiler is filled with scrap iron and the feed-water passed through it, so as to remove lime and other impurities.



PENNEY'S SLIDE VALVE ENGINE.

Penney's Slide Valve Engine.

The slide valve engine shown herewith is made from new designs by J. W. Penney & Sons, Mechanic's Falls, Me. Although the bed is what would be called "old fashioned" as compared to common construction of the present, it is strong, and adopted by the builders after careful consideration of its adaptation to engines of this type.

Pains have been taken in the design, throughout, to provide for continuous running and hard work. The cylinders are made of special iron, and neatly jacketed. The piston is fitted with self-adjusting packing. Crank shafts are of hammered scrap, and piston and valve rods of steel.

The particular engine shown in the engraving is rated at 60 horse-power; dimensions as follows: Cylinder, 14″ × 24″; steam ports, 12″ × 1½″; exhaust ports, 12″ × 1¾″; fly-wheel 8 feet diameter, weight about 3 tons; diameter of shaft, 7½″; length of bed 12 feet, width 2½ feet. The speed is controlled by a 4″ governor; exhaust pipe, 6″; weight of counter-balanced crank, 600 lbs. The total weight of engine 12,000 lbs.

A novel method of dealing with the matter of weekly payments, is recorded by the *Boston Journal of Commerce*, which says:

"The Collins Company, of Collinsville, Conn., has adopted a system of weekly payments, optional with the workmen, by which those who wish it can receive each week whatever sum they name not exceeding what is due to them, and once a month the accounts of all are settled as heretofore. This arrangement enables each man to be paid according to his wishes."

Compound Locomotives.

Writing to the *English Mechanic* upon Mr. Webb's engines, G. D. Seaton says, "They burn far more coal, use far more oil, want far more repairs, and more frequently lose time than the "Precedents," and if Mr. Rous-Marten calls that good work, I don't."

An item is going the rounds of the press to the effect that:

"A man in Chapinville, Conn., is said to have put in use a crank attachment to one axle of his wagon so arranged that as he drives along it works the dasher in a churn in the wagon and saves no end of hard labor at home."

Perhaps another "Downeast Yankee" will apply the device, "substantially as described," to the sewing machine, cradle and hash machine, and take the family on daily excursions.

It is stated that in a series of experiments to test the merits of several new Krupp guns, the result has been very disastrous. Several guns have burst and a number of gunners have been killed.

New Wrinkles for Forming Dovetails and Holes in Light Castings, and Plan for Holding Castings Straight.

By Thomas D. West.

When Mr. Joseph L. Gobeille read his interesting paper "Engineering and Mechanical Problems Relating to Stove Constructions," before the Civil Engineers' Club of Cleveland, he had as a sort of "side issue" several models, which I have made drawings from and offer you, with descriptions; they are valuable wrinkles which will interest moulders and foundry men.

In Fig. 1, by the use of tin plate pressed so as to give form to the mould the shape desired to be given the casting, smooth holes can be cast in lugs, etc., $\frac{1}{4}''$ or less in diameter. This saves drilling and insures accuracy in obtaining desired results. Seen at *A* is the end and front view of a piece formed of tin plate, and which before covering the pattern *B* with sand is set into the lug *D*. The tin former *A* is made tapering, the same as the hole in the pattern's lug *D*. This insures the tin former remaining in the mould when the pattern *B* is drawn. The metal, when poured into the mould, runs around the part *E*, thereby fusing it and the sides *F* sufficiently to make it firmly adhere to the cast-iron and present a neat-looking lug.

In Fig. 2 is illustrated the manner in which dovetails, etc., are formed by the use of tins. Section *H* shows the construction of pattern; *K* is the tin former which, remaining in the mould, forms the dovetail. A plan of this tin former is seen at *M*. To keep these tins in place while the mould is being rammed, projection *N* is used. The section *H*, likewise all the other sections of patterns shown have that side up which the mould has when placed upon the mould board. It will, of course, be evident to the moulder that the section *H* pattern, when rolled over, can be drawn out, leaving the tin *K* remaining to form the dovetail. The resulting casting obtained is illustrated at section *P*.

The forming of door catches, etc., by the use of tin formers will be understood by referring to Fig 3. The pattern, as is seen, has merely a straight tapering lug *R*, over which is set a hollow tin as at *S*. This tin former, like those previously described, remains in the mould.

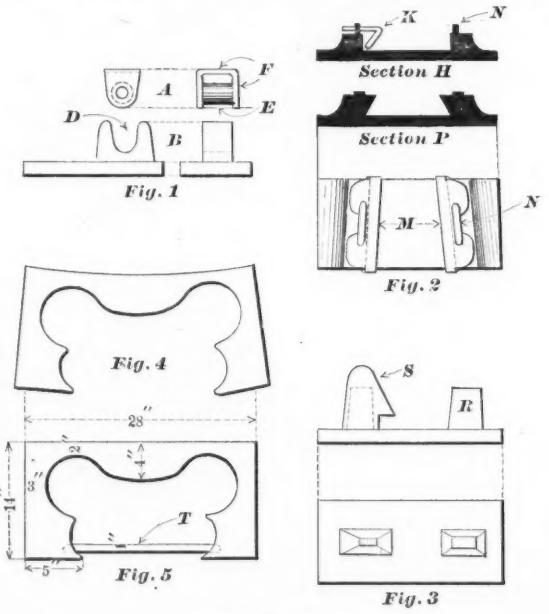
In some cases where the body of metal is heavy, the tin former would not be recognized on the casting's surface; but for such work as ordinary light stove castings, the tin former can readily be seen, as the heat is not sufficient to entirely fuse or melt it.

From the above descriptions and cuts given, the reader will, no doubt, easily understand the principle involved.

The *particular forms* of tin formers shown are patented by Mr. Burdick; but the writer believes that the idea, or principle, is applicable to a large number of purposes in castings, to save drilling, coring, etc.

The idea of being able to successfully accomplish the horizontal coring of holes, as small as $\frac{1}{4}''$ diameter, in castings, is alone something which will command the attention of foundrymen.

Fig. 5 is a sketch of a casting Mr. Gobeille presented, showing a mode which held a casting straight. When first making these castings, they would come out of the sand as seen at Fig. 4. To overcome this evil and keep the casting straight, the bar *T*, Fig. 5, was cast on, and was broken off after the casting became cold. This was said to give straight castings, as seen by Fig. 5. These castings were used for the tops of oil stoves, and, I should judge, were about $\frac{3}{16}''$ thick.



New Wrinkles.

Strength of Railroad Spikes.

An engraving in a recent issue of the *Railroad Gazette* represents a 60-foot washout on the B. and P. R. R., near Hebronville, Mass. The strength of the spikes held the rails in position, and a number of men passed over the gap, stepping from tie to tie. At Mansfield, Mass., a similar washout occurred, and a section of track, 150 feet long (double track in both cases), was sustained. A little figuring by the *Gazette* makes it appear that the spikes sustained a strain of from 37,000 to 150,000 each, while the theoretical strength of a common spike is only about 19,000 lbs.

Railway Shop Notes in Elizabethport.

When the New Jersey Central Railroad was built its terminus was at Elizabethport, connection being made with New York by ferry-boats.

A 16-stall round-house was built at the above place, and repair shops located in a straggling manner around the round-house. At present but three trains per day are made up at Elizabethport, the remaining large number being housed at Jersey City and Phillipsburg, the present termini of the road.

About 200 locomotives are cared for and kept in repair by Master Mechanic Wm. Woodcock, at the Elizabethport shops, besides all passenger and freight cars in use upon this division of the road.

The shops which are located in a haphazard fashion around the yard, are the result of addition after addition as the road demanded larger repair facilities, but all these shops are filled with an abundant supply of first-class tools.

No new locomotives are built at these shops, but an immense quantity of new work is constantly required in replacing worn-out material.

The extended smoke-box is used on 150 of the 200 locomotives; they all are adapted to burn anthracite coal, and are being applied, as fast as circumstances will permit, to all locomotives on the road.

The engraving and accompanying description by Master Mechanic Woodcock on another page of this issue shows very clearly the method of its application.

The condition of each locomotive is determined by daily inspection, and is recorded in the office in the form of weekly reports, which are received from every engine.

The blacksmith shops are fitted with suction pipes to carry away the smoke, which is received from the fires by hoods connected with the main pipes. One shop is fitted with an exhaust fan, but from some defect the pipes do not give as perfect satisfaction as those in another shop which run directly upward from the hoods to the open air, virtually forming a straight open chimney for the escape of smoke.

The foreman of the smith's shop said that he would guarantee to clear the shop of all smoke and dust if he could have the perpendicular open pipes and also have a series of perforated pipes near the roof of the shop and which should be connected with an exhaust fan of large capacity.

A device for checking the time of the men, as used by Mr. Woodcock, is shown by Fig. 1. It consists of a number of rolls about 2 inches in diameter, mounted just beneath the surface of a desk, as shown by the section in Fig. 1. Adjoining these rolls, and partly over them, are strips upon which are pasted slips of paper bearing the names of the men employed. Each shop, or branch of work, has a separate slip, as seen by the headings, "Shop," "Round-house," etc.

The timekeeper soon knows each man, and when one passes the window, before which the device is placed, the timekeeper draws a single diagonal line upon a sheet of

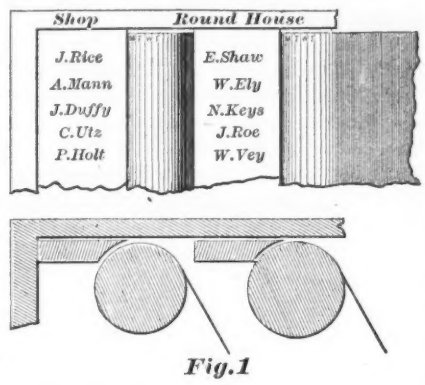


Fig.1

paper which is wound upon one of the above described rolls.

The paper, as may be seen from the engraving, is ruled like an ordinary time book, and in fact, after being filled with time marks, can be filed away as a leaf of a book.

When the man comes in at noon another diagonal mark is made across the one previously made, thus forming a cross, which indicates a full day's work.

Should a man be late, and not pass the timekeeper until after 7 or 1 o'clock, he is checked accordingly, and given a mark indicating 8, 2 or any hour at which he may go to work. In connection wiih this method the timekeeper visits each man and receives from him a statement or a card, which tells on what work the man's time has been spent.

At Elizabeth, where the Pennsylvania road crosses the tracks of the Jersey Central, occurs one of the worst places to keep in repair that is found upon the whole road.

Nearly 400 trains per day pass this point, and the method in use is to plane out the castings (previously cored) upon which the rails intersect, and rivet heavy steel bars into the spaces thus formed, the flange space being planed in after the steel is riveted in place. The steel "corners" thus formed, resist very well the severe pounding of the thousands of wheels which pass over them.

All the bolts used upon the division are made in the shop by a bolt machine, which is also made to punch all bolts which are held by keys in place of nuts.

No transfer table is needed in these shops, as owing to their dispersed arrangement they are all easily reached by a system of tracks and switches.

A machine for grinding up straight work, and which is now coming into extensive use in railroad shops, consists of an iron table with an emery wheel running beneath it, similar to the arrangement of a buzz planer. The top of the wheel is arranged a trifle higher than the top of rear part of table. The portion of table beyond the wheel is raised as high as the top of the wheel. When work is passed over the machine it is reduced to a true smooth surface.

In the tool room a cabinet is arranged for testing steam gauges. A large master gauge serves as a standard, and all gauges used on the division are made to agree with it.

It is customary when using master gauges to use a water column which serves as a check upon the master gauge. Sometimes a column of mercury is used, as it is more convenient on account of reduced height of column necessary. Some steam gauge makers use both water and mercury columns, and compel the readings of the two columns to agree with that of the master gauge, and the gauge being tested. As a substitute for the water and mercury columns a steel plate was chipped out until a cavity exactly one inch square was made in the top of the piece of steel. The sides were then bevelled off until the top of the steel plate represented four knife edges, enclosing precisely one square inch of space. Communication with the master gauge was made by means of tubing, with the space between the knife edges.

Another piece of steel ground to fit was laid upon the knife edges, and weighted to correspond with the figure to which the gauge was being tested.

For instance, the steel cover and weight carrier weighs 10 pounds. It is desired to test a gauge to 150 pounds, and weights weighing 140 pounds are placed on the carrier. As the pressure is pumped up the two gauges may be compared, and when 150 pounds pressure is reached the cover is raised from the knife edges, rendering it impossible to increase the pressure above that figure, serving a check upon the master gauge. By different weighing the gauges may be checked at any desired pressure.

An apparatus for testing vacuum gauges is constantly in use in this room, and also a machine for testing springs, by which the spring may be loaded to its working pressure, and then given a vibratory motion whereby the spring is compressed and extended as in actual work. By this machine the spring may be also tested to destruction if desired.

The paint shops are placed at the entrance of the yard, and isolated as much as possible from the other buildings.

Two large buildings are occupied by this branch, each building being wide enough to cover three tracks, and accommodating four cars on each track.

The stagings in use for painting are a noticeable feature in these shops. They consist of common horses 38 inches high, on which are placed strong 2-inch planks, of sufficient width to enable two men to pass each other easily. A $\frac{3}{8}''$ or $\frac{1}{2}''$ bolt runs through planking, horse and floor, rendering the whole staging solid.

Sufficient space is left between stage and car to allow a man to work comfortably when standing on the floor. This stage compares very favorably with that often found in car paint shops where ladders are much used, old barrels are pressed into use and considerable time is lost in climbing the rickety structure with doubt in mind whether time will be lost in a climb down, or paint lost in a tumble.

Some railroads utilize old freight cars for storage room, wherein to place the thousand pieces that go to make up the "findings" of a railroad supply shop.

In this shop an entire room is given up to the storage of portable articles, and from "brasses to lamp wicks," each article is "pigeon holed" under a plain table, rendering it easy to find any article wanted.

A machine for welding boiler tubes is very highly recommended by Mr. Woodcock. The operation of splicing a tube is not one to be envied when done by hand, but by means of a revolving mandrel and a pressure roller, mounted close to a small furnace, tube splicing is made an easy job.

In the construction of boilers, open-hearth steel is used entirely, flanging being done extremely well, as proved by several fine specimens exhibited.

Modern Locomotive Construction.

BY J. G. A. MEYER.

TWENTIETH PAPER.

LAYING OUT LOCOMOTIVE BOILER SHEETS.

For the sake of simplicity let us now suppose that sheet W has been laid out and rolled without any allowance for lap, or in other words, that the lap has been sheared off. Again, let Fig. 107 represent the boiler with the tapered course removed, and in place of the latter we insert the sheet W. Here we see at a glance that the sheet W is not large enough even if the lap had not been omitted. Notice, for instance, the edge $h\ g$ of the sheet W, Fig. 107; this edge ought to butt against the edge $h\ g_4$ of the cylindrical course, but which it does not. Now, in order to make the tapered course butt against the edge $h\ g_4$, the sheet W must be made wide enough, so that the line $f\ g$ can be lengthened to g_4 and the line 6 a to b and so on. If we now notice the edge $e\ f$, we find that, in this direction, the line $f\ g$ is too long by an amount equal to $f\ f_4$; and the other lines up to 3 a are also too long by an amount less than $f\ f_4$, indeed this amount decreases as we approach 3 a.

It seems to the writer that this figure should plainly indicate the principle of the construction to be employed hereafter in laying out a tapered course, and if the foregoing is understood, that which is to follow will be comparatively easy.

In making out a list of material required for the construction of a boiler, as shown in Fig. 98, the length and breadth of the sheet needed for the tapered course S, can be found by the following method: the length thus found will be somewhat too long, but since this sheet is generally ordered a little longer and wider than necessary, the practical value of this method will not be impaired.

Fig. 100. Let the outside diameter of the straight course T be 48 inches, and the thickness of all the sheets $\frac{3}{8}$ of an inch, then the outside diameter of the tapered course will be $48\frac{3}{4}$ inches.

Fig. 98. Produce the line $e\ h$ at one end to i and at the other end to j. Through the point A draw a line $A\ k$ perpendicular (that is, square) to $i\ j$, also through the point C draw another line $l\ j$ perpendicular to the line $i\ j$, and through the point B draw a straight line parallel to $i\ j$, and thus completing the parallelogram $i\ j\ k\ l$. Through the point g draw a straight $g\ o$ parallel to $i\ j$, then the surface between the lines $i\ j$ and $g\ o$ will be a curved surface, and the part between the lines $o\ g$ and $k\ l$ will be a flat surface. Although the tapered course joins two cylindrical surfaces it can easily be proved that the curved part of the tapered course is not cylindrical, *it is elliptical*, but for the sake of simplicity we will assume it to be cylindrical. We see that the outside diameter of the course is $48\frac{3}{4}$ inches; the circumference of a circle whose diameter is $48\frac{3}{4}$ inches will be 153.15 inches, but the curved surface is equal to only half the circumference hence

$$\frac{153.15}{2} = 76.57 \text{ inches},$$

which is the length required for the curved part of the sheet. To this must be added twice the distance between the line $k\ l$ and $o\ g$. Suppose we find by actual measurement this distance to be 10 inches, the total length of sheet will be $76.57 + 10 + 10 = 96.57$, say $96\frac{1}{2}$ inches. The breadth of the sheet is equal to the distance between k and l, and is found by measurement. Hence, our sheet, before it is rolled will be $96\frac{1}{2}$ inches long and its breadth equal to the line $k\ l$.

HOW TO LAY OUT A TAPERED COURSE WHEN ITS LINES $B_2\ C_2$ AND $B_3\ C_3$ AS SHOWN IN PLAN, FIG. 100, ARE PARALLEL.

We will first explain a simple method by which the curvature of the lines $B_2\ C_2$ and $B_3\ C_3$, Fig. 106, is determined approximately, yet near enough for ordinary practice.

Second. The correct method, and agreeing with that as shown in Fig. A by the Baldwin Locomotive works.

Draw on a blackboard two views of the tapered course as shown in Figs. 104 and 105. The arc $g_2\ h_0\ g_3$, in Fig. 105, represents the center of the thickness of the sheet; thus, for instance, if the tapered course is 48 inches inside diameter and the outside diameter $48\frac{3}{4}$ inches, then the diameter $g_2\ g_3$ will be $48\frac{3}{8}$ inches as shown. The shaded parts in Fig. 104 represent the amount of lap. Notice here that the line $g\ f$, which is the center line of the horizontal lap, coincides with the center line (or axis) of the boiler, and this line $g\ f$ is represented in Fig. 105 by the point g_2, the point g_3 represents the center of the opposite horizontal lap. Divide the arc $g_2\ h_0\ g_3$, Fig. 105, into any number of equal parts, say 14, and mark these divisions 1, 2, 3, etc., as shown. Through the points 1, 2, 3, etc., draw straight lines parallel to $x\ y$ and intersecting the line $h\ g$, Fig. 104, in the points $h_6\ h_5$, etc. Through the point e, Fig. 104, draw a straight line perpendicular to the line $e\ h$. Through the points $h_6\ h_5$, etc., draw straight lines parallel to $e\ h$, intersecting the line $e\ f$ in the points $i_6\ i_5$, etc., and also intersecting the line $e\ l$ in the points $e_5\ e_6$, etc. Here the line $h_2\ i_2$, in Fig. 104, and the line 2 i_2, in Fig. 105, will represent one and the same line, the line $h_3\ i_3$, Fig. 104, and the line 3 i_3, Fig. 105, will also represent one and the same straight line, and the same remark holds true for all the other lines drawn parallel to $e\ h$ in Fig. 104, and $e_0\ h_0$ in Fig. 105. Finally, let $M\ N\ O\ P$, Fig. 106, represent the edges of the sheet on which the tapered course is to be laid out. Through the center of the sheet draw the straight line $e\ h$ square with the edge $M\ N$. On the line $e\ h$ lay off a point e, the distance between it and the edge $M\ N$ being equal to the amount of the lap. Through the point e draw a straight line, $l_2\ l_3$, perpendicular to $e\ h$; or if the edge $M\ N$ is true, we may say draw $l_2\ l_3$ parallel $M\ N$; on the edge line $l_2\ l_3$ lay off 14 points e_1, e_2, e_3, etc., seven on each side of the center line $e\ h$, the distance between these points must be equal to the distance between the points on the arc g_2, h_0, g_3, Fig. 105. Through the points e_1, e_2, e_3, etc., Fig. 106, draw straight lines parallel to $e\ h$. The distance from the line drawn through e_7, on the right hand side of $e\ h$, to the line drawn through the point e_7 on the left, is that portion of the sheet which must be rolled. From e_7 on the left lay off a point l_2, and from e_7 on the right lay off a point l_3; the distance between l_2 and e_7, also that between l_3 and e_7 must be alike, each being equal to the distance between points l and e_7, Fig. 104. Through the points l_2 and l_3 draw lines parallel to $e\ h$. On each of these lines drawn parallel to $e\ h$, lay off a point in the following manner: From the point l_2 lay off a point f_2; the distance between these two points must be equal to the distance between l and f, Fig. 104. Again, from e_7, Fig. 106, lay off a point i_7; the distance between these two points must be equal to that between e_7 and i_7, Fig. 104. So also the distances between e_6 and i_6, e_5 and i_5, e_4 and i_4, etc., in Fig. 106, being respectively equal to $e_6\ i_6$, $e_5\ i_5$, $e_4\ i_4$, Fig. 104, and so on. Through the points f_2 and i_7, also through the points $f_3\ i_7$, draw straight lines; and through the points i_7, i_6, i_5, etc., draw a curved line. Again, from the point e, Fig. 105, lay off a point h, the distance between these being equal to the distance between the points e and h, Fig. 104. Make all the distance between $e_1\ h_1$, $i_2\ h_2$, $i_3\ h_3$, etc., equal to $e\ h$; also make $i_7\ g_2$ and $i_7\ g_3$ equal to $e\ h$; then through the points $g_2\ h_6$, h_5, etc., draw a curved line; join f_2 and g_2 by a straight line; also join f_3 and g_3. Draw the curved line $B_2\ A\ B_3$; the distance between this curve and the curve $f_2\ e\ f_3$ must throughout be equal to the amount of lap. Also draw the curve $C_2\ D\ C_3$; the distance between this curve and the curve $g_2\ h\ g_3$ must also be equal to the lap. Finally, draw the straight line $B_3\ C_3$ parallel to $f_3\ g_3$, and the line $B_2\ C_2$ parallel to $f_2\ g_2$; the distance between these lines must be equal to one-half the horizontal lap. The curved lines $B_2\ A\ B_3$ and $C_2\ D\ C_3$; also the straight lines $B_3\ C_3$ and $B_2\ C_2$ are the lines to which the sheet must be cut.

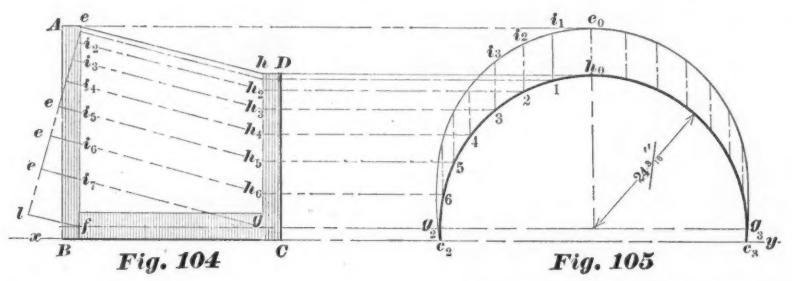


Fig. 104. Fig. 105.

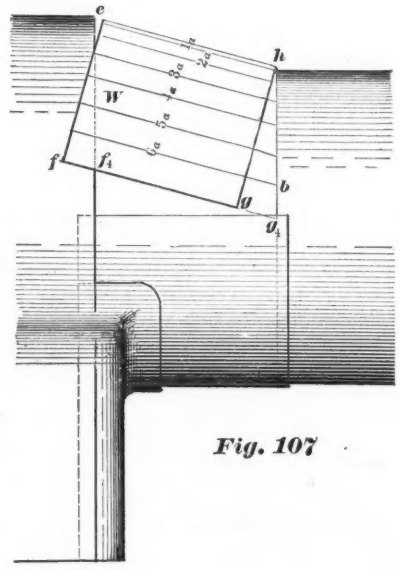


Fig. 107.

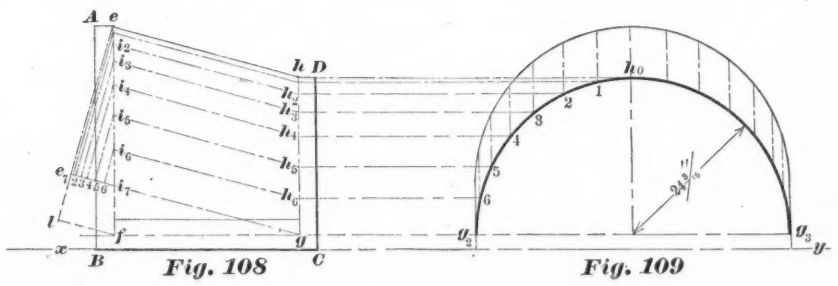


Fig. 108. Fig. 109.

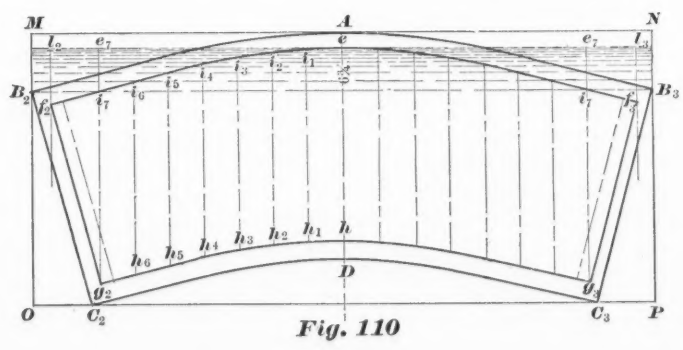


Fig. 110.

CORRECT METHOD.

Draw the views Fig. 108 and Fig. 109. Divide the arc $g_2\ h_0\ g_3$, Fig. 109, into fourteen equal parts. Through the points 1, 2, 3, etc., draw straight lines parallel to $x\ y$ and intersecting the line $h\ g$, Fig. 108, in the points h_1, h_2, h_3, etc. Through e, Fig. 108, draw a straight line $e\ l$ perpendicular to $e\ h$. Through the points h_1, h_2, h_3, etc., draw straight lines parallel to $e\ h$, intersecting the line $e\ f$ in the points i_1, i_2, i_3, etc.; also through the point g draw $g\ e_7$, and through f the line $f\ l$, both parallel to $e\ h$, so far our construction is as in Fig. 104; through the points i_1, i_2, i_3, etc., draw straight lines parallel to $e\ l$ and intersecting the line $g\ e_7$ in the points 1, 2, 3, etc. Let $M\ N\ O\ P$, Fig. 110, represent the edges of the sheet on which the tapered course is to be laid out. Through the center of the sheet, and perpendicular to the edge $M\ N$, draw the line $e\ h$; on this line lay off a point e; the distance between this point and line $M\ N$ must be equal to the lap. Again, on the line $e\ h$, commencing from the point e, lay off the points 1, 2, 3, etc., and the distances between these points must be equal to the distances between the points 1, 2, 3, etc., on the line $g\ e_7$, Fig. 108; that is, from e to 6 in Fig. 110 must be equal to that between e_7 and 6, Fig. 108; and from e to 5, Fig. 110, equal to e_7 and 5, Fig. 108, and so on. Through the points 1, 2, 3, etc., Fig. 110, draw straight lines perpendicular to the line $e\ h$; or, if the latter is square with the edge $M\ N$, we may say draw through the points 1, 2, 3, lines parallel to the edge $M\ N$. From the point e, and with a distance equal to that between the points 1 and 2 or 2 and 3, Fig. 109 (the distances between these are all equal), describe an arc intersecting the line drawn through the point 1, Fig. 110, in the point i_1; from i_1 as a center, and with the same distance as before, describe an arc intersecting the line, draw through the point 2 in the point i_2, and in a similar manner the points $i_3\ i_4\ i_5$, etc., are found. Through these points draw straight lines parallel to $e\ h$, as shown. From the point e_7 on the line $l_2\ l_3$ lay off a point l_1, the distance between e_7 and l_2 being equal to that between e_7 and l, Fig. 108; in the same manner lay off the point l_3 on the left hand side. Through the points l_2 and l_3 draw straight lines parallel to $e\ h$; on these lines lay off points $f_2\ f_3$; the distance between l_2 and f_2, and also that from l_3 and to f_3, each being equal to $l\ f$ in Fig. 108. Through the points f_2 and i_7 draw a straight line, also join f_3 and i_7 by a straight line, and through the points $i_7\ i_6\ i_5$, etc., draw a curved line. Through the points $i_7\ i_6\ i_5$, etc., draw straight lines parallel to $e\ h$, and make the lengths of all these lines equal to that of $e\ h$ in Fig. 108, and thus obtaining the points $h_1\ h_2\ h_3$, etc.; through the points g_2 and f_2 draw a straight line, also join f_3 and g_3 by a straight line; draw curved line through the points $h_1\ h_2\ h_3$, etc. Outside of the curved line drawn through $i_7\ i_6\ i_5$, etc., draw another curved line $B_3\ A\ B_3$, the distance between these lines must be equal to the lap. Also draw a curved line $C_2\ D\ C_3$ parallel to $h_1\ h_2\ h_3$, etc., the distance between these curved lines must be equal to the lap. Lastly, draw the straight line $B_2\ C_2$ parallel to $f_2\ g_2$, the distance between these must be equal to half the horizontal lap; also draw $B_3\ C_3$ parallel to $f_3\ g_3$ the distance between these must also be equal to the horizontal lap. Cut the sheet to the curved lines $B_2\ A\ B_3$ and $C_2\ D\ C_3$, and also to the straight lines $B_2 C_2$ and $B_3 C_3$.

The difference in the shape of the sheet for the tapered course laid out according to the first method, and that laid out according to the second method, is very slight. In the first method, the curved part of the tapered course is assumed to be cylindrical. In the second method, the curved part is assumed to be elliptical, which it really is. The rivet holes in the tapered course should always be marked off when the sheet is placed in position, and then drilled.

LETTERS FROM PRACTICAL MEN.

Steam Heating vs. Furnace Heating.

Editor American Machinist:

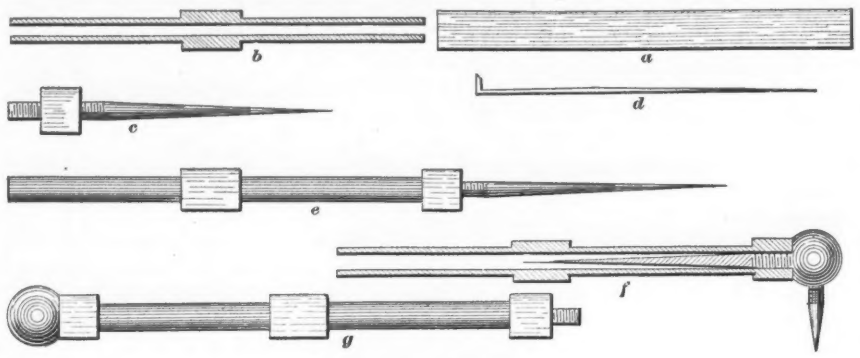
I see by the April 10 issue, under the above caption, that Mr. S. A. Beckett has taken you to task for your advocacy of steam for heating private dwellings, etc.

Please permit me to second your whole article, also to state that I have had some twenty years experience in the erection and management of heating apparatus of various kinds, and the following "bits of experience" may be of interest.

Some twenty-four years ago I had charge of three hot-air furnaces in the high school building in this city, a building about sixty feet square and three stories high. To warm this building in fall weather, required that the fires should be started not later than 6 A. M., in order to have the rooms attain a temperature of 70° Fah. by 9 A. M. The rooms were provided with ventilating registers both at the floors and ceilings, the lower ones to be used when the rooms were chilly and the upper ones when too warm. Fresh air was admitted from outside to each furnace and conveyed therefrom through ample sized flues to the heating registers located near the floor in the rooms to be warmed. If I remember rightly, three sets of furnaces were burned out in six years time, when the heating by furnace was abandoned and steam introduced. While the furnaces were in use the scholars remained at home when the thermometer registered below 20° Fah., as they knew the building would be too cold for a school session. By the use of steam, there is no time at which it is necessary to dismiss school on account of a lack of warmth. I know of several private residences in town also, where the furnaces for heating have been superseded by steam. All prominent residences here are fitted with steam-heating apparatus, unless the owner is engaged in selling hot-air furnaces. At the institution where I am employed, we have tried hot-air furnace heating in several of the buildings, and that too, where the system should have worked to its best advantage, as, besides having ventilating flues leading to a central shaft, heated by the escaping products of combustion from the furnace, there was an open grate fire in the rooms. It was impossible to warm them higher than to about 60° Fah. After trying this method in various ways, for two seasons, steam was substituted and no trouble afterward experienced in properly warming any room without the use of the grates. We also found that even heating by indirect radiation (steam) the action of the air within the rooms was very similar to that from the hot-air furnaces, but by placing the radiators in the rooms to be warmed, and introducing fresh air from outside of the buildings and conveying it through a register 10″x12″ placed under each radiator, no trouble is experienced in supplying warm, *moist* air in abundant quantity for health and comfort. The last method I think is the only true one to warm a building when the inflow of air is left to natural causes. The best plan is to force in the air by means of a ventilating fan, but this is only possible where motive power of some sort is near at hand. Another thing, it would not be possible to heat a group of detached buildings, as these are here, from one heating station, by the hot air system of furnaces. The main steam pipe leading from boiler house to our school building is a little over 1,000 feet in length, yet no trouble is experienced in warming this building with not to exceed 20 pounds pressure on the boilers, and during the coldest weather. Mr. Editor, I never heard of a steam heating apparatus being taken out of a building and a hot-air furnace put in its place. Did you?

A word in regard to the moisture of steam heat: Steam engineers, at least, are all taught that metals are composed of molecules, the minutest of minute particles, atoms, that under the influence of heat are continually in motion; we cannot have separate atoms or molecules without spaces between them. Steam is a vapor, invisible when in contact with heat. From the above I reason that it is possible for moisture to be imparted to the air of a room heated by steam, even though every joint in the boiler and piping is absolutely and practically steam tight. The loss of water from the steam heating boiler I first had charge of was a great mystery to me, (it was on the gravity system by direct radiation). The boiler was perfectly tight, also the system of piping, but still there was a slightly perceptible loss of water, with not a "sis" to be heard or a drip anywhere about the apparatus. I inquired of scientific men who I thought could give me a solution of the mystery, but without avail. Since then I have noticed the same thing taking place in every such apparatus I have seen, and the only conclusion I can arrive at is, that the steam *does* insinuate itself between the molecules of the iron of which the radiators are built, causing this loss of water and moistening the air of the room. No evaporating pans are necessary where steam is employed for warming, by hot-air furnaces they are required.

E. MANSELL,
Chief Engineer Mich. State Public School.
Coldwater, Mich.



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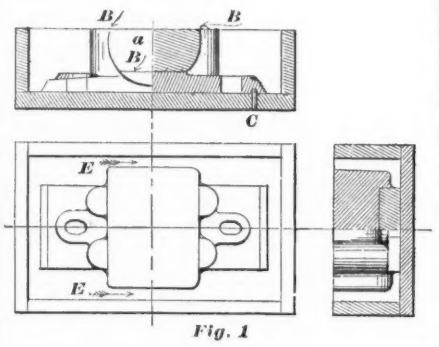

Fig. 1

Moulding Pillow Blocks.

Editor American Machinist:

I wish to enumerate a few of the several ways in which to make patterns for boxes or pillow blocks, by which the moulder can do more rapid and satisfactory work than suggested by Aaron Louis in AMERICAN MACHINIST of March 13th, as the difficulty of extracting collars from the sand is entirely done away with.

Fig. 1 shows pattern placed in a box, a space being allowed all around for sand. The part *a*, forming the journal, is made solid, and in a separate piece, with a parting from main body of pattern on line *B B B*, the latter being held in position with pins, one of which is shown at *C*. A core is made from this box, and where its surface comes in contact with the casting it is given a good coat of blacking.

Should the core become too cumbersome, by allowing a space at ends of journal *E E*, of such magnitude as to permit a sufficient quantity of sand to give the core the necessary strength for handling, a rod may be put in to accomplish the same result, with enough of sand to protect casting from coming in contact with the rod.

Fig. 2 shows a square block whose outside dimensions are equal to inside of box, Fig. 1, with journal bearing cut out in center, and on which we also fasten core prints for bolt holes for holding cap. This block is rammed up by the moulder, and when drawn out of the sand the cores are put in, and the mould is so far complete.

Fig. 3 is a sectional view of mould, showing the cores in their proper position. In practice the block should be made a trifle large so as to permit a free or easy introduction of the core *F*, Fig. 3; this method, however, can only be used to advantage where the boxes are of moderate size for not exceeding a 3½″ or 4″ journal.

Another way, and which as a general thing gives very good results, it to part the pattern in center on line *D D*, Fig. 4, using cores for journal bearing and bolt holes.

Core boxes required in making cores used in this method should, if the saving of time

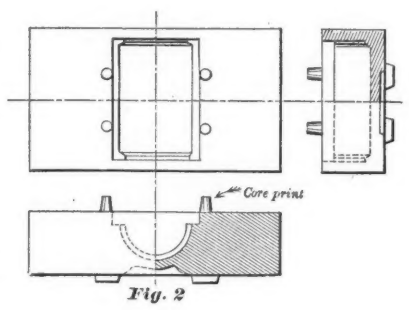

Fig. 2

in moulding is an object, be made to stop off their own prints, the arrangement of core prints is shown on under side, or sole of pillow block, in plan view of Fig. 4.

A common practice is to make pattern as in Fig. 5, with a core print on each side of pat-

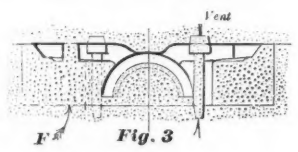

Fig. 3

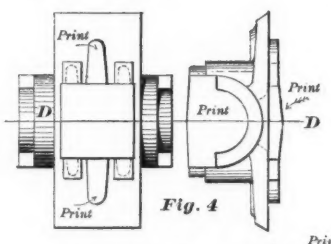

Fig. 4

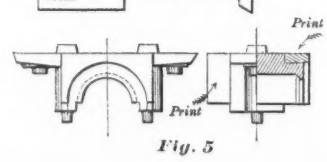

Fig. 5

tern, so as to core out the outside of babbitt collars. In this method the casting is all made in the drag, and I do not hesitate to say that it is practicable to make a pillow block in this manner, no matter how large it may be.

WM. HULTGRAN.

Pocket Scriber.

Editor American Machinist:

I have always found that one important tool has been omitted from catalogues of machinists' tools, and that is a pocket scriber.

I have tried time after time to procure the same at hardware stores, and, being unable to do so, I made a common scriber like *d*, but, being unable to keep track of the same, I made the scriber shown by *e* and *f*, which is easily carried in the pocket.

I obtained a piece of copper four inches long, and drilled a hole through it lengthwise, and turned down both ends until it looked like *b*, leaving it nothing but a shell. A portion in the center was left larger to facilitate handling. I then tapped out both ends about ¼″ deep.

Next I made a piece like *c* for the scriber point; this was made of steel and turned, threaded and fitted so that either end could screw into *b*.

I then got out another piece about one inch long and fitted it to screw on the end of *c*. This piece formed the "inside scriber," and when in position for use it looked like *f*. When not in use this right angle point can be screwed into the end of the copper piece at the end opposite to that occupied by *c*.

In this position the scriber looks like *g*, and may be carried in the pocket without danger of accident. It is not patented.

N. L. M.

Steam and Furnace Heat.

Editor American Machinist:

In your issue of April 10th Mr. Beckett accuses the writer of the article published on your editorial page of March 27th with not having given much thought to the subject of house heating by steam. Is not Mr. Beckett a little mistaken? I had read that article and formed the opinion that the writer was thoroughly conversant with the subject. I venture the opinion that steam heating for houses is as much of an improvement over furnaces as lighting by electricity is over lighting by gas, or as heating by a furnace is superior to heating by stoves.

This fact is so generally recognized that the only reason for using furnaces is their low first cost. The reasons why steam heaters are displacing and superseding the hot air furnace are: First, economy in fuel; a good steam heater compared with the best hot air furnace will do the same work with one-third less fuel, and often with one-half. Second, durability; the piping, radiators, etc., of a low pressure steam heating plant are good for a life of fifty years, and the boiler will last at least twenty years. Third, efficiency; wherever a radiator is placed, there you get heat, and it does not matter where the wind blows from; no matter what Mr. Beckett may say to the contrary, those that make and those who use hot air furnaces know too well that they cannot force warm air to the upper rooms on the north and west sides of a house on a blizzard day, just when heat is most needed. It is well known that registers and hot air pipes used for furnaces are generally too small when it is proposed to put in steam to take the place of the furnace. Why? because the furnace heats the air to a very high temperature (burns the air would be a better expression). But with steam coils or indirect radiators the pipes and registers need to be larger, because the air is at a much lower temperature, and it consequently requires a greater volume to do the same work. Mr. Beckett seems to have never heard of indirect steam heating, as he says, "the advantages of a furnace are first and most important a supply of fresh, warm (not hot) air and a complete system of ventilation not possible with steam as usually used in radiators." I beg to say that the hot air furnace has no monopoly of taking cold air from outside, and warming it before sending it into the room. The State of New Jersey has thousands of homes heated in that way by steam.

HUGH J. BARRON.

How many steam gauges in actual everyday use are known to be correct? In how many engine rooms are there any means for determining whether a steam gauge is correct or not? The cost of a steam gauge is but a few dollars. If one was purchased for every engine room and preserved for the purpose of testing the gauges in everyday use, it would serve a valuable purpose. Occasionally it could be returned to the manufacturer for verification. The satisfaction of knowing exactly what steam pressure is being carried, to say nothing of safety, is worth more than the extra expense involved, which, as intimated, is trifling.

A hydraulic collision buffer is described in a recent issue of *Iron*, which is to be applied to vessels and locomotive engines. This buffer contains combined water and air springs, and is intended to cut off steam from the engines of a steamer, arrest the motion of the vessel and destroy its momentum while it is moving 45 feet.

When applied to locomotives it is to absorb the striking force of a train in a distance of 7½ feet.

Railroad Cost Cards and Expense Sheets.

By "Records."

The exchange of cards by railway master mechanics in this country, giving the cost of maintenance of locomotives on different railways, has enabled them, to a certain extent, to make comparisons between the cost of the same on the different lines and with their own. With the exceptions of the brief time spent by master mechanics at their annual conventions, they have but few opportunities for personal exchange of views and experiences with the different appliances they may be using, or the different classes of locomotives on their respective lines. In fact, it is well known that, as a rule, in localities where several lines may center, and have their shops within a few miles of each other, that the master mechanics seldom meet for any purpose, much less to exchange views. Their knowledge of each other is generally from reputation, and of what each may be doing by the accounts given in the mechanical journals, and which generally consists in a statement that Mr. A. or B. is using or trying this or that appliance or design of locomotive. What the result of that trial may be is seldom known. The journals cannot follow it up, and, as a rule, master mechanics are chary about giving information relating to an appliance they may have, or have had, on trial, especially if it has proved a failure, or no benefits have been derived from its use.

The many changes that have been made in locomotive construction, in detail and in whole, during the past ten or fifteen years, for the purpose of increasing efficiency and reducing cost for repairs and consumption of fuel, should furnish valuable information for the future. In fact, in no equal period of time in the history of railways has there been such a diversity of construction. The different lines throughout the country are using locomotives of designs which they consider best adapted to the class of traffic they may have, the geography of the country through which they run, and the fuel that can be obtained the cheapest in the locality. With but few exceptions, several designs have been tried, and are in use. Yet beyond the expression that "moguls or consolidations etc., etc., are the best for our use," we have no definite knowledge of what benefits have been derived from their use, or what defects discovered, to guide us in the future. The general expression of the good or bad qualities of a locomotive are not sufficient; the details should be given to enable others to judge intelligibly if the class would answer for a road in another locality, where the geography of the country and the water and fuel were different.

The information that could be obtained by the exchange of expense cards, were they made more definite than the present ones, and made to give the amount of work done, the cost of doing it, and by what class or design of locomotives on a road on which it was done, would be of benefit to master mechanics at large. But as it is, the present ones are only interesting as showing the cost of maintenance of the whole on the road from which these cards come, and the factors in the cost of maintenance are so varied throughout the country that they cannot be used in making a comparison between the cost on the different roads, and with this known, the present method cannot be an incentive to a master mechanic to reduce his own.

If the charges in locomotive maintenance are considered, it will be found that they can be grouped under several headings. Under one will be found those due to the cost of fuel, cost of attendance and repairs, as affected by the rate of wages in the locality, and the cost of supplies. In the latter, the amount of oil and waste used will depend more upon the soil and climate of the country through which the road runs than upon the design of the locomotive.

Under another heading can be put the cost of repairs and amount of fuel consumed; these are the only charges in maintenance that are affected by the design of the locomotive. The cost of repairs will be affected by the system of making them, but when the same system is applied to all classes of locomotives on a line, any difference in the cost of repairs to locomotives of a class, and as a class, will be due to the design, and the economy or cost for the whole maintenance will show the master mechanic's ability.

The amount of fuel a locomotive uses is largely affected by its draft appliance, as well as by the design of the boiler; in the individual locomotive by its conditions and the ability of the engineman. But when taken as a class these later influences will be small, and are as liable to exist in the one class as another. What class of locomotives will do work the cheapest, is what railway managers want to know, and if the cards could give the work done, with the amount of fuel used and repairs made in doing it by the several classes of locomotives on the line issuing the card, and give the kind of draft appliance used, dimensions of boiler and fire-box, driving-wheels and cylinders, in place of the information most of them now give, which can be obtained elsewhere if desired, they would be more useful, and cost no more to compile.

Any information to be of benefit should be concise and clear, and relate to matters that are within control and bear upon the results given—that if good they may be copied, and if bad avoided. This, as a rule, the cards do not do, and, as they are compiled from the same accounts as the expense sheets, posted in engine houses, we also find there many of the defects found on the cards. While the latter are intended to show the performance or value of the whole locomotive power on a road, the former are to show to the enginemen the performance of their engines, and their skill in operating them, and enable them to make comparisons with others.

If the engineman has time and a step ladder he will find somewhere in the many columns of figures some that will interest him or apply to what he has control over, which will be the amount of fuel consumed, and to a certain extent the amount of supplies and repairs. The amount of repairs he will be interested in; the amount of stores not so much so, as he knows that he does not use all the supplies charged to his locomotive. But the first—the amount of fuel consumed—will interest him, as he knows he can largely control it, but he feels that if the amount is large in comparison with that used by others, that with the present form of sheet, with a column given to each kind of supplies, one to the total, another to the cost of repairs, and still another to the amount of fuel consumed per mile, and again, columns for each 100 miles, that if his performance is bad it is not conspicuous, and that if good no one will see it. But also the sheet to give the amount of fuel used, the cost of repairs and stores used per mile, or 100 miles, in three columns, it would draw his attention to a plain sheet, with the locomotives of a class grouped, giving in the fewest figures and columns the amount of fuel consumed, cost of repairs and amount of stores is all that is required.

The cost of fuel and supplies, wages of attendants, and waste and oil used for cleaning is beyond the engineman's control, and, while it is necessary that it should be kept by the department, the record belongs in the office. Compiling these for posting in the engine house is not only a useless expense, but complicates the sheet and hides that portion that should be conspicuous, and that could be made more so were it known what amount of fuel the locomotives of a class should use and the sheet to give it to make a comparison by.

Were the effort made to find what amount of fuel should be used, it would be discovered that the average locomotive is not the most wasteful machine constructed when it is properly handled; that the ash pan damper has another purpose than covering the hole through which the ashes are pulled, and that its use should be varied as often as the locomotive works and the condition of the fire varies; that steam blown through the safety valve has an equivalent in fuel from the consumption of which no benefit has been derived, and that proper firing is a large factor in the successful and economical operating of a locomotive.

A recent paragraph in the American Machinist says in substance that the present efficiency of the engines in ocean steamships is not so much due to any radical change in construction as to intelligent use. Inversely one might say of the locomotive that its defects are not so much the fault of design as lack of knowledge of what it can do and how to best make it do it.

The lack of knowledge cannot alone be laid at the door of the enginemen, but at that of the management as well, who ask them to attain to a point that they themselves do not know, or the means of attaining it, or if they do, do not give the directions.

With the present growing system of establishing loads for the locomotive and loading cars to their capacity, it would seem possible to ascertain what amount of fuel should be used by the different classes of locomotives during the several seasons of the year. Were the amount and means known, enginemen would know what they had to do, and how to do it. Failure to keep to the amount of fuel would be due to the fault of the enginemen, the condition of the locomotive or the quality of the fuel; and it would be of benefit to railways, had they a standard that would show when there was a fault, and where and how to remedy it.

If much of the present talk of what the locomotive should and ought to be was on what it is and can be made to do, it would be more profitable to the railways, who must use the present type of locomotive until the ideal locomotive is in the market, and would develop the fact that the American locomotive is as economical and efficient as its brother on the other side, when it is as well managed and its management as well directed.

The Compound Steam Engine for Stationary or Factory Purposes.

By William H. Hoffman.

FIRST PAPER.

The compound engine has "come to stay." As a marine engine for the Atlantic "liners" it has worked wonders. The consumption of fuel on a 9,500-ton ship, engine developing 11,000 horse-power, and making twenty and a half knots per hour, is about 2½ lbs. of coal per horse-power per hour; and this is accomplished under great disadvantages, compared with the usual conditions of service of a stationary engine.

The marine engine has no ponderous fly-wheel to assist in using a short cut-off, no massive foundations to hold the engine in line and none of the perfect regulating devices now in general use on land engines that keep them within two per cent. of a uniform speed.

Fifteen years ago, to obtain a speed of fourteen and a half knots per hour, the European steamers were burning about 3½ lbs. of coal per horse-power per hour, as an average.

Hornblower, Woolf, Earle, Whitman, Joseph Eve, Atkin, Gillman and Steel, all English and Scotch engineers, built compound engines for land service, between the years 1781 and 1824, and in 1842 Henrik Zander built a three-cylinder compound, one high and two low-pressure cylinders, the low-pressure cylinders being jacketted, the steam for this jacket coming directly from the boilers.

Zander's engine proved the most economical, as it was double-acting, and the speed of the piston was about 380 feet per minute, while nearly all of the former experiments were made with single-acting engines, and the pistons rarely moved over 200 feet per minute, the average being below that speed.

The early compound engines were not compact, compared with the amount of power developed, as the initial steam-pressure was never more than three atmospheres, while we now work the compound from seven to ten atmospheres, with from seven to fourteen expansions.

It is said that Zander found in jacketting the low-pressure cylinder, that even at the low pressure of 55 lbs. absolute, too much heat was absorbed by the injection water. The temperature in the jacket was that due to 55 lbs. absolute pressure, while the *initial* steam temperature in the low-pressure cylinder was that due to 17 lbs. absolute, the average being about 7 lbs., and the temperature accordingly, making due allowance, of course, for condensation.

Under these conditions, the jacket was for a time abandoned, as the *jet* condenser was the only one in use at that time, and the waste or outboard pipe from the hot-well was carrying off too much heat from the steam jacket.

Right here I will say that most of our modern *land* compound engines have the jet condenser, as they are generally located near a river or stream where plenty of fresh water can be had, so that with the low-pressure cylinder jacketed, receiving the steam direct from the boilers at the modern pressures of 90 to 120 lbs., there must be some waste of heat by its transmission through the thin low-pressure cylinder to the condenser, where it is in direct contact with the cooling water.

The first gain by the use of the jacket is holding up of the pressure from the initial to the finish of the stroke. How much of this gain is counteracted by the escape of the heat to the condenser, is a question often under discussion; but one thing is certain, that of the amount of heat, be it small or great, thus escaping, only a very small percentage is passed back to the boiler in the feed-water. As before remarked, our boiler pressures are from 90 to 120 lbs., the initials at the high-pressure cylinder being from 85 to 115 lbs., and the initial in low-pressure cylinder never being above 45 lbs. absolute, generally from 18 to 30 lbs., with temperatures to match these pressures.

A jacket on this low-pressure cylinder would contain steam at 115 lbs. pressure and a temperature to match it; some of this will be absorbed by the cylinder body, some by steam inside, and the cold water at the condenser will take its share, and carry it off, "tossing its toll" to the feed water, as it passes by.

With a *surface* condenser attached to the compound engine, the conditions are somewhat different, as a larger portion of the heat that may escape from the jacket to the condenser is at once returned to the boiler, the only loss being that from radiation. Of course, some of this heat passes off by radiating through the condenser tubes into the rapidly moving, circulating water; but practice shows this loss to be much less than when using a jet condenser. The heat passing to the cooling water in the surface condenser does so by radiating through the tubes, but by direct contact in a jet condenser. The surface condenser returns all the steam condensed to the boiler, the jet condenser only a portion of it.

Mr. Henry Reynolds, one of the contributors of the American Machinist, has just left Ithaca, N. Y., to engage in business in Peru, Ind., with A. J. Ross, who has a foundry and machine shop. The *Daily Journal*, of Ithaca, says: "Mr. Reynolds takes with him a pocketful of commendations of the strongest character certifying to his ability as a mechanic and his honor as a man from many of the most eminent firms here. All who have had relations with Mr. Reynolds speak kindly of him and his skill, and it is to be regretted that Ithaca is to lose an artizan of such merit."

Robert Hardie, well known as an inventor of compressed air locomotive and motors, will enter upon the duties of superintendent of the New York Locomotive Works, at Rome, N. Y. Mr. White, the present superintendent, goes to the Schenectady Locomotive Works as assistant superintendent.

Petroleum for fuel under boilers si again being quite extensively tried in England, not with a view to finding cheaper fuel, but one for some purposes more convenient. There is some evidence that progress is being made in the direction of getting better economical results than those usually obtained in the use of petroleum.

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Settlement of Railroad Strikes.

News from railroad labor troubles in the Southwest has been decidedly unpleasant to the general public for the past three or four weeks. The main arteries of commerce in three or four States have been clogged so that business has suffered severely. Worse still, violence and bloodshed have resulted from a continuance of the struggle. These occurrences are deplorable, and the question of paramount importance to the people at large is, how to prevent such struggles in the future. A strike of the employes of a chartered railroad presents a case quite different from a strike in a private industrial establishment. With the latter the public has no right to interfere, however long it may last. But a railroad company enjoying chartered rights and privileges conveyed to them by the people, is under obligations to so use them as to avoid, if possible, any interruption of the business they are depended upon to conduct. Doubtless the strike of the workmen on the Gould railroads was ill advised, but that fact does not justify the responsible head of the railroad system in refusing to take reasonable steps to settle the strike promptly, when invited to do so. He seems to think he has the same right to allow the traffic of several thousand miles of railroad, of which he has control, to lie idle indefinitely while trying to make the strikers surrender unconditionally, that the owner of a private manufactory has to shut down whenever he has a dispute with employes until he is satisfied to resume. Strange as it may seem, there are a number of daily newspapers that echo and applaud this idea. Such an unrestrained power in the hands of one man would be a serious danger to our free institutions. Almost anybody who has noted the progress of the Southwestern strike is convinced that it could have been easily settled any time during its earlier days had the governing power of the railroads been earnestly desirous of settling it. It would seem to better serve the financial interests of that power to utter threats and have the contest continued. The public have a right to demand that it be settled and traffic resumed. Their interests are not satisfied by having it merely *smothered* to break out again suddenly whenever the vanquished forces shall have been sufficiently recruited. The only way such a strike can be fully *settled* is by bringing the causes of difficulty freely before conference committees, or by means of arbitration. The party in the right has everything (that is, everything legitimate) to gain and nothing to lose by submitting to arbitration. A United States law may not compel settlements of disastrous railroad strikes by arbitration, but popular opinion should exert such a pressure in that direction that neither the companies nor their employes could afford to resist it. Happily the general relations between employes and managers of most other railroads in this country do not exist in that chronically strained condition so long observable on the Gould railroads of the Southwest. Usually there is a pride among the employes of a well managed railroad about the smoothness with which operations are conducted. This feeling should always be encouraged.

Fire Alarm for Deaf Mutes.

How to arouse the inmates of a deaf and dumb institution, when a fire breaks out in the night, without touching each of them is a problem that has long puzzled the managers of such institutions. Until recently they had not been helped to solve it by scientific or mechanical achievements. The Crosby Steam Gage and Valve Company, of Boston, has produced an instrument that gives the necessary alarm by vibration of the ground and buildings. It is their single bell chime whistle, four feet long and twelve inches diameter. One of them of this size has been placed upon the boiler house of the Jacksonville (Ill.) Institution for the Deaf and Dumb, and its operation is thus described in the weekly *Advance*, published by the inmates:

"A large majority of the pupils are conscious of its signals when given, and if more favorably located, which will be done hereafter, all of them would be.

"Since beginning its use, it has not been necessary in the morning to arouse any of the boys by any oth- -ans, and so many of the girls are awa- -y it that they immediately "call others. -he fir- under or -ever go out, and the steam -lown, -d as there alway- -n d- day and night fr- -to another, the value of -n case of fire is incalculable. -upils could all be awakened in one -nd many lives that would, without -xtreme danger, are as safe as the -f -s who hear."

The whistle gives three distinct tones, simultaneously, and although loud is not offensive. The weather predictions are received at this institution every noon and sounded on the steam chime; one long sound indicating fair weather; one medium long and three short sounds, cold weather; six short sounds, -weath- ; six short sounds in pairs indicating -g- -ther. The people for -and- -by notified of what

Business Prospects Brightening.

A few months -notes of changes in rates of wages paid by -industrial establishments were almost invariably about reductions. Lately, these changes have been nearly all advances. Instances of voluntary advances of ten or fifteen per cent. are by no means rare. Every day brings news of such advances from various sections of the country. We also hear of frequent additions to force and the starting of idle shops, mills and manufactories. These things indicate unmistakably a better condition of business and give promise of further improvement in the future. Prices of iron and machinery have not advanced as had been expected, but the tendency is toward higher prices. Now is a good time to start new industrial enterprises.

The article which appears elsewhere in this issue on Railroad Cost Cards and Expense Sheets was prepared by an experienced railroad man, occupying an important position. His argument for greater conciseness in expense sheets, bringing out important items in a way that they may be readily come at and understood, unmixed with irrelevant matter, is worth much consideration. Those who have had experience in efforts to reduce expenses in any kind of business understand that it must be done by a careful consideration of items, hence the importance of having every item stand out clear by itself.

A correspondent asks for information regarding a well-designed furnace for heating spelter used in galvanizing wire. Some of our readers may be able and willing to advise him.

Shop Hazing.

We have received from a new correspondent, employed in a large railroad shop, a communication on the above subject, which is written with marked fluency, and which describes in detail many of the jokes journeymen often play upon raw apprentices. To the readers of a literary journal who are not mechanics, it might prove very interesting; but while it might amuse, it would hardly be likely to instruct mechanics, so far as concerns its main details. Our correspondent thinks such apprentices should meet hazing good-naturedly, and that to many it will be likely to teach lessons of fortitude and self-control that will be of value in later life. He concludes with a specially good point, as follows:

"In nearly every trade, profession or business, advantage will be taken of the ignorance of the newly-admitted student or apprentice, to a greater or less extent. But it is a singular fact that most of the hazing done by so-called highly educated and refined collegians is far more brutal and severe than would ever be attempted by mechanics."

Steel-faced Electrotypes.

A firm of electrotypers in New York are making steel-faced electrotypes. We have no further information as to utility or price, than contained in the following. They write us: "Steel-facing electros is putting a coating of steel on an electrotype to harden face, or when electros have to be printed with red ink prevents discoloration of the ink; in short it performs the same duties as nickel-facing, only being harder and more durable.

We recently visited the round-house of a suburban railroad in a Western city. It was equipped with a lathe, a planer, a drill press, and small tools for doing ordinary repairs to their "dummy" engines, but the machine that seemed to be the pride of the establishment (and the only one we saw running) was a large, well-mounted grindstone. Conspicuously posted near at hand was a notice forbidding any but employes of the road to use that stone. This is the only shop we ever saw in which the grindstone was its most attractive feature. Usually it is about the worst looking fixture to be seen in the shop. We can imagine the chagrin of the small boys with dull jack knives, the butchers with dull cleavers, and the farmers with dull scythes as they approach that inviting grindstone and read the forbidding notice.

Literary Notes.

A REPORT ON THE TERMINAL FACILITIES for Handling Freight of the Railroads Entering the Port of New York, especially of those railroads having direct Western connections. By Gratz Mordecai. Published by the *Railroad Gazette*, 73 Broadway. Price, $1.50.

This work will be of undoubted interest to those who have occasion to ship or receive freight through New York. It details the manner of receiving and transferring freight, time consumed in doing so, and the plans adopted.

Maps of the different locations described in the text illustrate the subject.

The forty-fifth meeting of the American Institute of Mining Engineers will be held at Bethlehem, Pa., beginning Tuesday evening, May 18, 1886. The chairman of the Local Committee is Mr. John Fritz, and the secretary is Mr. Albert L. Colby, Lehigh University, South Bethlehem.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(171) W. W. G., ———, writes: Does the piston of a locomotive really move during the back stroke, that is with regard to some fixed point outside the engine? *A.*—W. G. will find this question discussed in Question and Answer No. 149, in the AMERICAN MACHINIST of April 3, 1886.

(172) W. S. & S., Hunter's Mill, Va., writes: I have a grindstone which is too soft. Is there any way of making the stone harder, but still allow it to cut freely? *A.*—Exposure to sunshine is said to harden some kinds of stone, but the best method is to buy a new stone.

(173) R. M., Beloit, Wis., asks: What is ganister? Neither Webster's Unabridged nor Chambers' Encyclopedia has the word? *A.*—Ganister is a refractory substance used for lining furnaces. Webster's latest edition (supplement) gives the following definition: "A refractory material used for lining the Bessemer converters. It consists of crushed or ground siliceous stone mixed with fire clay."

(174) W. H., Duluth, Minn., asks: What size governor is necessary for an engine 30″x40″ seventy-five revolutions, steam pressure 90 lbs.? also what size steam pipe? *A.*—If the pipe is reasonably short and direct, we should say a 9″ pipe would be right, and a governor of the same size; many would use an 8″ pipe and governor. 2. What is the opening through governors, compared with the sizes? *A.*—It differs. Some make the area equal to pipe, as for instance, a 3″ governor will have opening equal to the area of 3″ pipe; others do not give so much opening. In all throttling governors the intention is that a governor of a given size shall be ample for steam pipe of same size.

(175) G. H., Newark, N. J., will find directions for making blue prints in the AMERICAN MACHINIST of Oct. 8, 1881.

(176) Y. C., Sacramento, Cal., writes: I wish to raise water through 300 feet of pipe, 75 feet high. A miner proposes a system of endless buckets, but I think a wheel would be best. Have unlimited water supply and fall. Which do you think would be best? *A.*—We should use the wheel.

(177) I. H. B., Waldboro, Me., asks: What is the action of the snap packing as used in steam engine pistons, and is it perfectly tight? *A.*—The snap or spring ring packing consists of (generally), two narrow rings, turned a little larger than the bore of cylinder, and sprung into grooves turned in the piston. It is found very satisfactory in use, but no packing is perfectly tight.

(178) J. L. L., Waterbury, Conn., writes: Can you give me a rule, without the use of algebra, for calculating the angle (in degrees) for cutting spiral mills on the Browne and Sharpe milling machine? *A.*—Divide circumference of cutter in inches by the pitch, or number of inches to one turn. Look out this number in Haswell's, Nystroms, any other table of natural tangent, and you will find the angle in degrees.

(179) G. E., Brooklyn, N. Y., asks: How do you find the horse-power of a locomotive, and what is the horse-power of a locomotive 13″x20″ running twenty miles per hour, with 130 pounds steam pressure? *A.*—You can find the horse-power exerted by a locomotive only by the use of an indicator or dynamometer. The horse-power of the locomotive mentioned may be four times as much under some circumstances as under others. Anything except an actual test will be the merest guesswork, and of no value.

(180) J. B. G., Baltimore, Md., asks: 1. How shall I calculate the heating surface of a boiler? *A.*—Compute all the surface in square feet which has water or steam on one side of it and furnace heat on the other. 2. How shall I make fire-proof mortar for boiler setting? *A.*—Use Kaolin, which can be bought from dealers in cements. 3. How many revolutions do dynamos make? *A.*—From 200 or 300 to 2,000 or 3,000 or more, according to size and construction.

(181) F. X., Houston, Tex., writes: 1. We are running a dry-room with 3,000 feet of 1′ pipe, using a 10 horse-power boiler. The boiler is fed by an injector, from street main. About what per cent. of fuel could be saved by using a return steam trap. *A.*—There is not sufficient data on this subject from which to predict the exact saving, but it will be large, entirely too large to be neglected. 2. Could the injector be used to return the hot water? *A.*—No. 3. What is the greatest temperature a pump can be relied upon to return the water if it flows to the pump? *A.*—There is practically no limit, if the arrangement is perfect.

(182) W. B., Salmon Falls, N. H., writes: We had a 70 horse-power steel boiler and a 50 horse-power automatic engine. Engine runs 62¼ hours per week. We have also 650 feet of 1¼″ pipe with steam on three hours per day, and 1020 feet of 1″ pipe in radiators; they are supplied by a ⅜″ pipe. The boiler is fed by a plunger pump, through a good feed-water heater, we blow down about 3″ of water daily, on account of bad water. Steam is on radiators one hour per day. The time is between March 21 and 28. The average consumption of fuel in this time was one cord of soft wood per week for starting fire and 143¾ pounds of Cumberland coal and 734⅓ pounds of screenings per day. The average steam pressure is 55 pounds. What I want to know is if we are wasting fuel? *A.*—We have no means of knowing how much work your engine is doing. It is plain that it is no where near 50 horse-power, as that alone would call for a good deal more fuel than you use. So far as we can judge from your statement, you are getting along very economically in the use of fuel.

(183) H. S., Metropolis, Ill., asks: What is laminated steel and how is it manufactured? *A.*—Laminated steel is made by welding together a number of thin sheets of steel into a solid plate or mass. 2. What is Damascus steel? *A.*—Damascus steel comes from India and Persia. It contains a large amount of carbon (over 7 per cent), and can only be successfully worked at certain temperatures, which are located by climatic limits. If too high a temperature is used, the steel breaks under the hammer; if too low, it becomes brittle and hard. Certain kinds of Damascus steel contain nickel, tungstate of iron or manganese, from which combination the steel seems to receive a considerable quantity of carbon. Artificial Damascus steel has been produced by smelting soft iron with charcoal, tungstate of iron, nickel, and manganese.

Another method consists of melting fifty parts of iron with one part of lamp black or by smelting cast iron with oxidized iron filings. 3. Where are gun barrels made and how are twist barrels made? *A.*—Gun barrels are made at Colt's Armory, Hartford, Conn., and at many other places. Twist gun barrels are made by coiling up a strip of iron, like a coiled wire spring, and then welding the coils together. 4. Are the Damascus barrels twist? *A.*—They may be made so, but welding is said to destroy the lines for which Damascus steel is noted for exhibiting after it has been corroded by acids, owing to a division into two carburets, in the steel, by cooling at certain temperature.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Power measured.–F. Van Winkle, 22 Cortlandt, N. Y.

Alt, Mechanical Engraver on Wood, 318 B'way., NY

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Screws and turnings in brass, special shapes, estimates made on samples; Ottumwa Iron Works, Ottumwa, Ia.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

"Morrison's Practical Engineer." A complete treatise (200 pp.) on steam and general mach. Mailed on receipt of $1. W. A. Morrison, Box 373, Lowell, Mass

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See April 3, p. 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Bound Volumes of the AMERICAN MACHINIST for the years 1880, 1881, 1882, 1883, 1884 and 1885. These volumes are strongly bound in cloth, and will wear well. Price $3.50 each; express charges additional. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. For sale by John Wiley & Sons, 15 Astor Place, New York.

Draughtsmen, Engineers, Pattern Makers and others—The undersigned would call their attention to a treatise on the construction of gearing compiled from the best authors, containing 125 illustrations of all kinds of tooth wheels of shafting, and all forms of connections wherein the odonlograph of Prof. Willis is illustrated, its use in laying out gears explained, and the excellent form of teeth which it gives is exhibited. On receipt of $1. the treatise will be sent to any part of the U. S. On receipt of $3. the book and instrument will be sent as above. John C. Reed, 57 Governor street, Providence, R. I.

Recommended by that eminent writer on the Principles of Mechanism, Prof. R. H. Thurston, Director of Sibley College of Mechanic, Arts, Cornell University, to whom I also refer. Circulars and index of contents sent free.

"Locomotive Engine Running and Management." By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air-brake explained by aid of engravings. Price, $2. For sale by Angus Sinclair, 175 Dearborn street, Chicago, Ill.

MANUFACTURES

The Uxbridge, (Mass.) woolen mills are to be rebuilt.

S. F. Cushman, Monson, Mass., will rebuild his woolen mill which was recently destroyed by fire.

Jas. Lancewood is building an iron foundry in Pittsburgh, Pa.

Joseph F. Brewster will erect a brick brass foundry at Chester, Pa.

W. H. Adams, of Corinth, Miss., proposes to add a two-story machine shop to his iron works.

Daniel A. Chenoweth, of Indianapolis, Ind., will build an addition to his nail factory.

The works of the Champion Blower and Forge Co., Lancaster, Pa., will be enlarged.

Waller & Stout, of Bellaire, contemplate erecting large boiler works at Martin's Ferry.

The Granite Plaid Mills, Haw River, N. C., is to have built an addition 75x225 feet.

W. J. Dexter, Dover, Me., will build a large wood-working establishment at that place.

S. J. Fries, Altoona, Pa., expects to put in a $20,000 outfit of planing machinery.

An addition is being made to the Hawthorne Woolen Mills, Glenville, Conn.

The Gardner Governor Co., Quincy, Ill., have voluntarily advanced the wages of all their employes from ten to fifteen per cent., to take effect April 3.

The Somerset Mechanical Works, Limited, Somerset, will erect a new machine shop early in the summer.

The blacksmith and machine shops, of the Louisville & Nashville railroad, at New Orleans, have been destroyed by fire. Loss, $20,000.

The Singer Manufacturing Co. will establish a branch sewing machine factory at Rensselaer, Ind., to employ 100 men. It will cost about $30,000.

The *Pioneer Press*, of St. Paul, Minn., says O. E. Hughes will commence the erection of a foundry and machine shop at Aberdeen, Dakota.

E. Brood & Sons., St. Stephen, Me., intend to make extensive additions to their axle factory.

A machine shop for the manufacture of sugar cane mills, is being erected by the Elyton Land Co., Birmingham, Ala.

W. L. Holt and Edwin C. Holt will erect a new steam cotton mill at Company's Shops, N. C.; 100 looms and 2,000 spindles will be put in.

It is said that William Slawson and Mr. Hart will build a foundry and machine shop at Dayton, Tenn.

The Chicago, St. Paul, Minneapolis, & Omaha Railroad will probably erect new car shops at Altoona, Wis.

J. F. Smith, of Rochester, Pa., has purchased ground at Beaver Falls, for the purpose of erecting a large manufactory.

Geo. Thacher, of the Middletown Tube Works, Middletown, Pa., contemplates building a tube works factory at Youngstown, Ohio.

It is reported that John D. Heard, Danbury, Ga., will start a factory for manufacturing agricultural implements.

The Bigelow Carpet Co., Clinton, Mass., intend to build a three-story addition to their factory, 84x250 feet.

The Old Colony Railroad Co. has increased the pay of engineers to $3.60 per day, and firemen to $1.90.

The Dennison Manufacturing Co., Brunswick, Me., will enlarge their mills and add considerable new machinery.

The laborers and employes of the Himrod Furnace, at Youngstown, O., have been notified of an advance of ten per cent. in wages.

Atherson, Harvey & Kebblers have leased a factory building at Greenup, and will start a stove foundry.

The Great Falls, (N. H.) Manufacturing Co. will rebuild their mills at Milton, which were burned last summer.

The Globe Woolen Co., Utica, N. Y., will build an addition to their mills for the manufacture of fine yarn.

A large textile factory will be built at Millville, Pa., by Henry Margerison & Sons, who will remove their factory from Germantown, Pa., to that place.

Kilmer & Co., of Schnectady, have purchased land of Adam Relyea, at Voorhiesville, N. Y., where they intend moving their shops for making wire bands.

The Brown & Sharpe Manufacturing Co., Providence, R. I., are now running with 509 men on the pay roll.

E. B. Rogers, of Beverly, will remove his business to Mansfield, Mass., where he will erect a shoe factory 100x40 feet in size. The town has voted to exempt him from taxation for five years.

The Knights of Labor at Spencer, Mass., have formed a co-operative company, with $75,000 capital, to start up David A. Drury's boot and shoe factory, which has been idle nearly two years.

New Bessemer Steel Works are to be erected near Pittsburgh. Geo. H. Boulton and J. W. Doubleday, of Chataqua, Pa., are parties interested.

The Piedmont Wagon Co., Hickory, N. C., have recently erected a brick building for an engine and boiler room and machine shop, and have placed some new machinery in their factory.

Chas. Adams, 77 Murray street, New York, will erect a five-story factory on Sands street, Brooklyn, 53x93 feet. It will have an elevator and be heated by steam.

A good part of Brown & Bros. brass plant at Waterbury, Conn., has been sold to new parties, who will start up the works at once under the firm name of Randolph, Clowes & Co.

The Delaware Rolling Mill, at Phillipsburg, N. J., has started up with five furnaces, after several years of idleness. More furnaces will be put in operation and more men employed as soon as extensive repairs now going on are completed.

A. G. Turner, who has occupied a room of the Holland Silk Co., Willimantic, Conn., for several months, has leased Seabury hall on Centre street, in that city, and will fill it with silk machinery. He expects to get started about the first of May.

This Spring the Brainerd & Armstrong Co., New London, Conn., will make extensive improvements in its works. The dye house is to be enlarged and the building on Union street will be extended as far as the house now occupied by the Rev. Mr. Nordell.

L. S. Buffington, of Minneapolis, Minn., is the architect of the machinery and mill implement shops about to be built at St. Cloud, in that State. The building will be 320x264 on the ground, and will cost $120,000.

The contracts for building the silk mill at Guilford Conn., have been awarded. Work will be begun immediately. The main building will be three stories high, 110 feet long and 45 feet wide, and will have a tower 15x20 feet and four stories high. There will also be engine, boiler and dye houses.

Arthur F. Gaylord and Fred Chapin have formed a copartnership for the manufacture of swords and are putting machinery in the McClellan building on Chapman street, Chicopee, Mass., which they have leased for that purpose. They will continue their foundry business on Summer street.

The Brown & Van Arsdale Manufacturing Co., having sold their factory and grounds at the corner of Michigan and Kingsbury streets to the Chicago, Lake Superior & Evanston Railroad, will shortly prepare plans for the erection of new works in the vicinity of Grand Crossing, Ill. They received $80,000 from the railroad for their property.—*Chicago Industrial World.*

The new catalogue of the Pond Machine Tool Co., of Worcester, Mass., shows cuts of nearly all kinds of machines required in a general machine shop. It is a 136 page pamphlet in pocket form. All the machines are briefly described. We recently saw a new double lathe for turning steel-tired car wheels in the new car shops of the N. P. R. R., St. Paul, Minn., which was built by this company. Mr. Cushing, the Supt. of Motive Power, expressed himself as highly pleased with it.

At the No. 2 shaft of the Excelsior Coal Co.'s Mines, at Excelsior, Iowa, owned by the C., M. & St. P. Railway Co., and under the management of Mr. Benjamin Wightman, general superintendent, during a recent ten hours' run there were mined, screened and loaded out of one shaft and over one pair of scales, 1,727 tons of lump coal, filling 121 cars, while the total of lump and nut together would not vary materially from 2,000 tons for the total day's out-put.

This so far as the parties have knowledge is the largest ten hours out-put of soft coal on record in the United States, under similar circumstances, particularly considering the fact of their having averaged a daily out-put of about 1,150 tons of lump both before and since, with no especial preparation for a heavy run upon that day. At this shaft the company use engines manufactured by the Ottumwa Iron Works, of Ottumwa, Iowa, consisting of a double hauling engine with cylinders 12x16 and four iron drums 48″ in diameter with a capacity of 5,000 feet of rope, each provided with clutches and brakes and an automatic index for showing the location of the train. Also a pair of double hoisters with cylinders 12x20 and suitable operating appliances.

Henry F. de Bardeleben, of Birmingham, Ala., Robt. Adger, I. Ellison Adger, David Roberts, Moses E. Lopez, Jos. S. Murdock, Augustine T. Smythe, and Jno. H. Murdock, of Charleston, S. C., W. S. Manning, of Spartanburg, S. C., Geo. S. Brown, of Baltimore, Md., Collin C. Wyllie, Jno. F. Gordon, Alfred Parish, Dillwyn Parish, and E. H. Watts, of London, Eng., have incorporated at Birmingham, Ala., the de Bardeleben Coal & Iron Co., capital stock $2,000,000, to do a mining, manufacturing and industrial business. The material for erecting two furnace plants at Jonesboro will soon be purchased. It is proposed by the company to erect a steel plant also.—*Baltimore Manufacturers Record.*

A new industry has been established in Carondelet, Mo., by Theodore and John Plate, father and son, respectively, the former president of the American Wood Preserving Company. As explained to a representative, says the *Age of Steel*, the coating of sheet iron or steel with copper, brass or bronze is purposed by use of the Walenn, an English process. A non-acid bath—which is the patented part of the invention—is charged with electricity, and a coating of any thickness desired is secured. Samples furnished from the works in Carondelet show a very superior order of copper-plating, the copper having apparently taken hold and become an indestructible part of the surface of the sheets. The output of the works is as yet small but the prospects are that it will be greatly augmented in response to a demand for the coppered sheets, as a substitute for galvanized iron. The present cost of preparing the sheets is somewhat in excess of the cost of galvanizing, but improved facilities and experience will no doubt bring about economies in this particular. The Missouri Pacific Railway Company have furnished specifications for the lining of 100 cars with the coppered sheets, instead of with galvanized iron; and in other directions the outlook for sales of the new product are flattering.

Machinists' Supplies and Iron.

New York, April 8, 1886.

The market has been dull and featureless. The demand has been almost entirely of a retail character.

Iron—In American pig the contract deliveries nearly absorb production. No. 1 X, Foundry, at tide water, $17.00 to $17.50; Standard, Lehigh and North River, $18.00 to $19.00; Grey Forge, $16.00 to $16.50.

Scotch Pig—Quiet and steady. Coltness, $20.25 to $20.50; Glengarnock, $19.50; Gartsherrie, $19.50 to $20.00; Summerlee, $20.25.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Position as foreman pattern-maker; first-class references. Address Box 6, Am. Machinist

Wanted—By a first-class machinist and draftsman, a position as draftsman; correspondence solicited. Address Myron, Am. Machinist.

Situation as superintendent of engine or machine works, reference covering 20 years experience. Address Harrison, care American Machinist.

Experienced supt. of machine works wants situation where good management will count. Heavy work preferred. Address, H. B., Am. Machinist.

Wanted—A machinery salesman of experience and ability. Practical machinist preferred. Address giving age, experience, salary expected, etc., Letter Carrier, No. 116, Chicago, Ill.

Wanted—Situation by a first-class machinist used to fine intricate work. Works from drawings only. Best of references given. Address E. C. S., Am. Machinist.

Wanted—Situation as foreman in machine shop on light tools or hardware m'fg. Ingenious, energetic. Strictly business references given. Address M. L. D. Am. Machinist.

Wanted—A traveling salesman; one acquainted with wood working machinery; state age, experience, etc., with expectations. Address Box 440, Am. Machinist.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Cyclone Steam Flue Cleaner has no equal. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Pennington & Mills, 8 Dey st., Jersey City Heights, N. J.

Wanted—Medium-sized, good second-hand iron planer, Address, H. Guenther, Owensboro, Ky.

I will furnish drafts or casting of shoe-nail, tack or hairpin machinery. Can build and operate. Address "Drafts," Am. Machinist.

10,000 Names of users of Machinery, steam engines, boilers, in N. Y. & N. J. Best *Trade Directory*. Send for circular. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

C. F. Langston & Co., 222 N. 5th st., Phila., canmakers' tools, presses, dies and special machinery built, rotary cutters made and ground.

Wanted—One internal gear about 36" dia. 3" face to bolt on back of face plate. One pinion about 5" dia. to match, send prices to Morrissey Bros., Foundry and Machine Shop, Crookston, Minn.

For Sale—One new 20" swing 12-foot bed engine lathe. One new 1⅛" Merriman bolt cutter. Full description on application. Address, box 886, New Haven, Conn.

Martin Bros., manufacturers, Lock Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

Engine and Boiler—30 horse-power Buckeye engine; 42"x12' tubular boiler; all pipes and fixtures, including injector, heater and smoke-stack; the whole in good condition; in use about three years; to be replaced by larger engine, etc., of same make; can be seen in operation until May 1. Address Geo. A. Barnard, 70 Astor House, New York.

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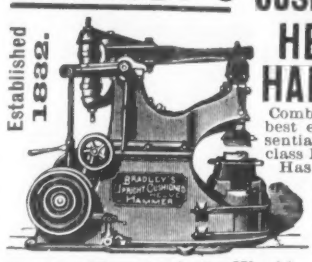
Established 1832.



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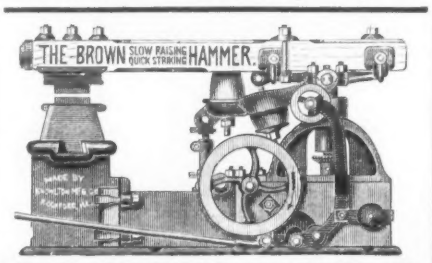

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A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock, situated in Leadville, Col. The business will be carried on until sold, thus at once giving a profitable trade to the purchaser. Address,

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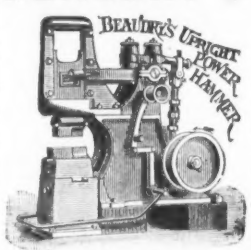

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Samples and Descriptive Price Lists Free.

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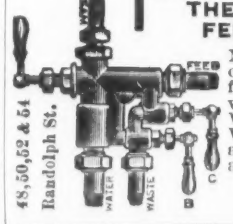
THE BEST BOILER FEEDER KNOWN.



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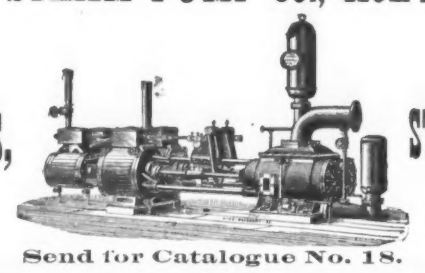

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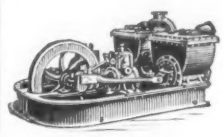

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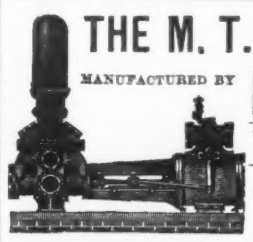

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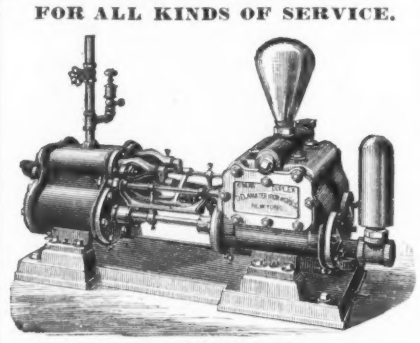
FOR ALL KINDS OF SERVICE.



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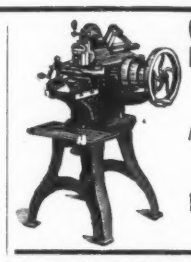

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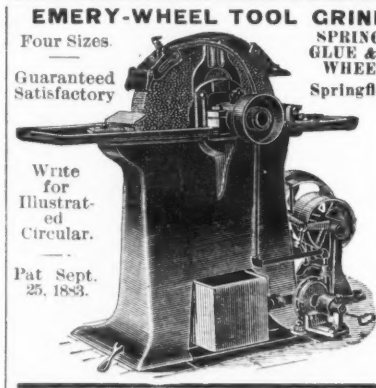

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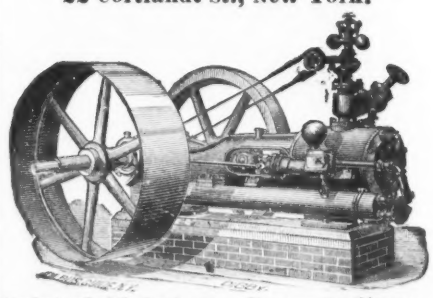

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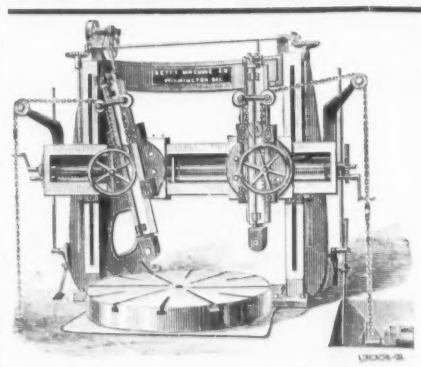

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Spindles not round, but of such shape as will allow ready adjustment for wear.
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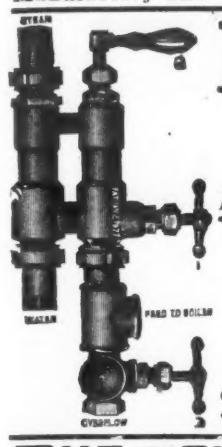

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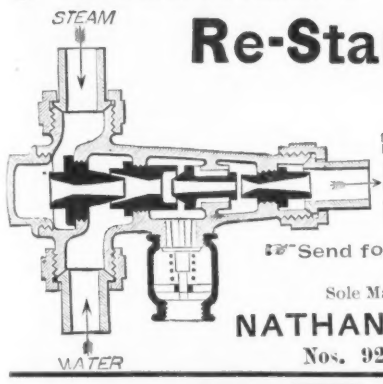

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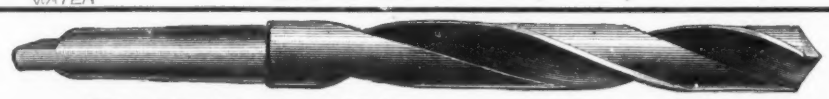

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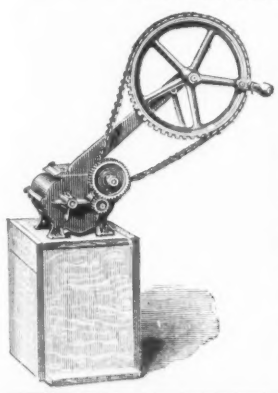

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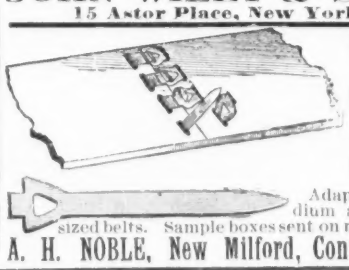

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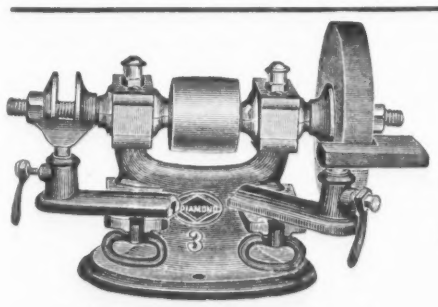

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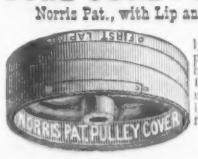

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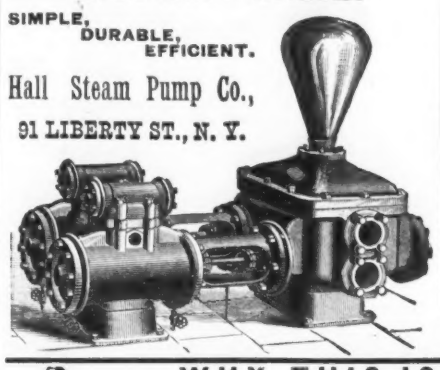

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3	5-8	.60
4	3-4	.60
5	7-8	.70
6	1	.70
7	1 1-8	.80
8	1 1-4	.80
9	1 3-8	.90
10	1 1-2	.90
11	1 3-4	1.10
12	2	1.20
13	2 1-4	1.35
14	2 1-2	1.45
15	3	1.60
16	3 1-2	1.80
17	4	2.10
18	4 1-2	2.75
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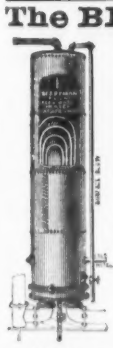

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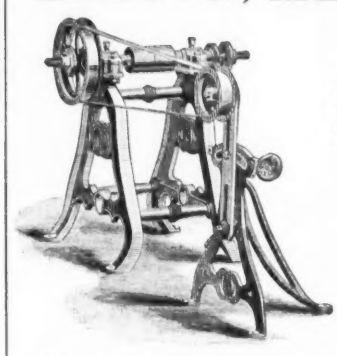

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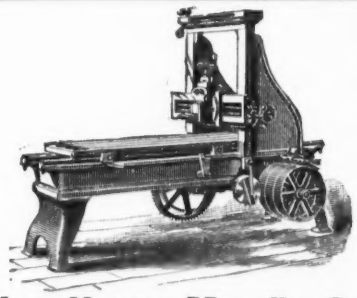

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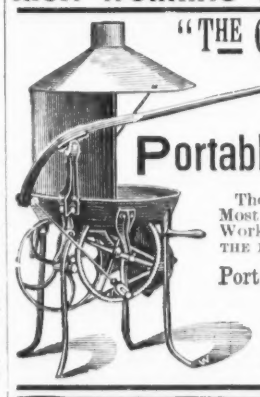

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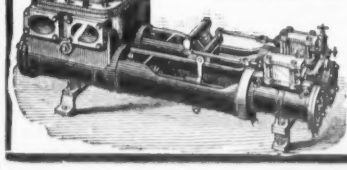

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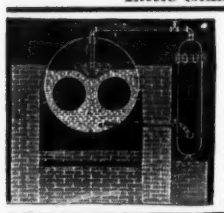

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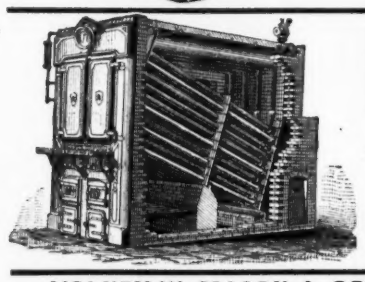

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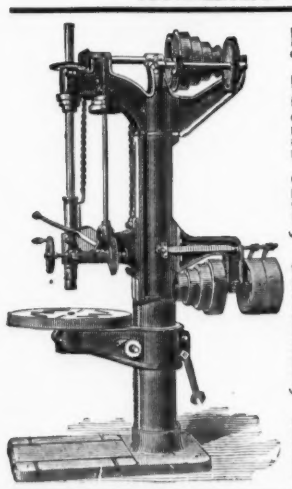

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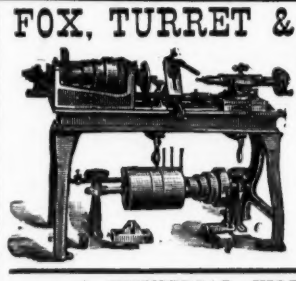

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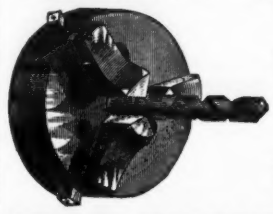

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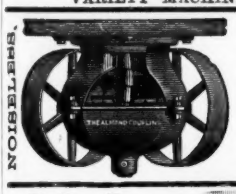

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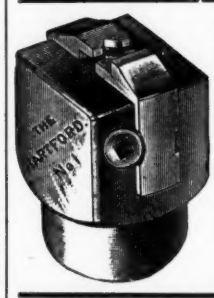

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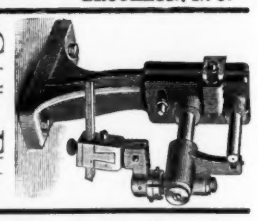

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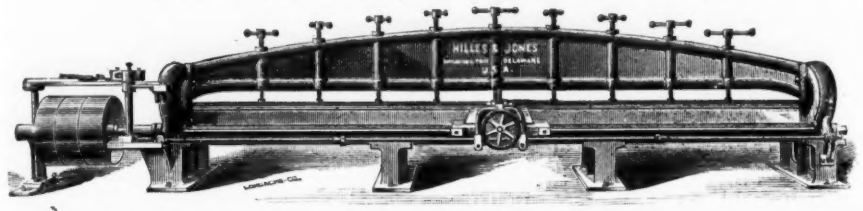

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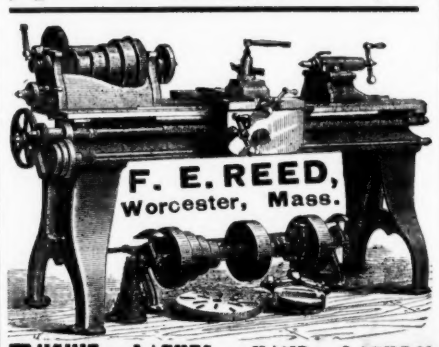

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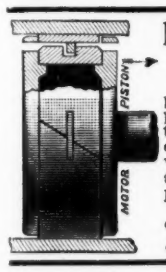

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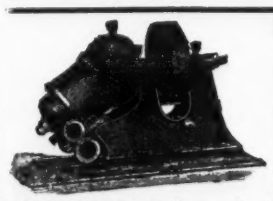

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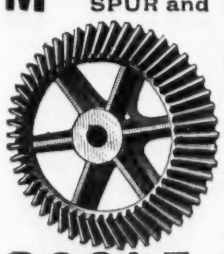

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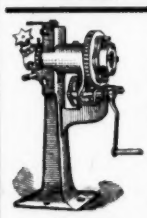

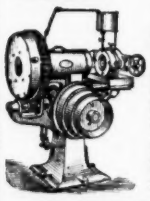

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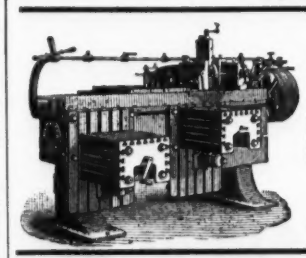

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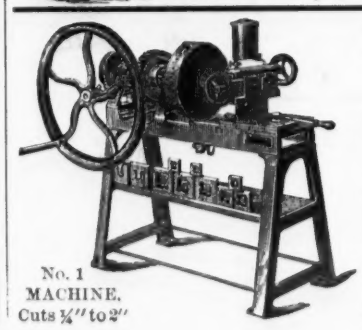

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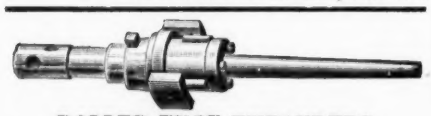

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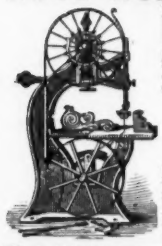

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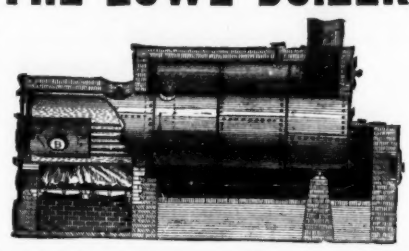

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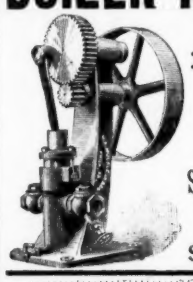

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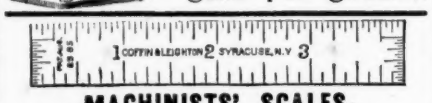

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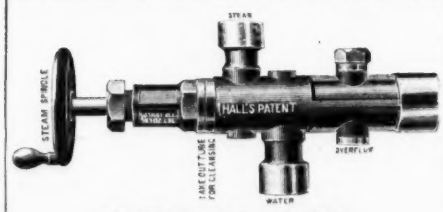

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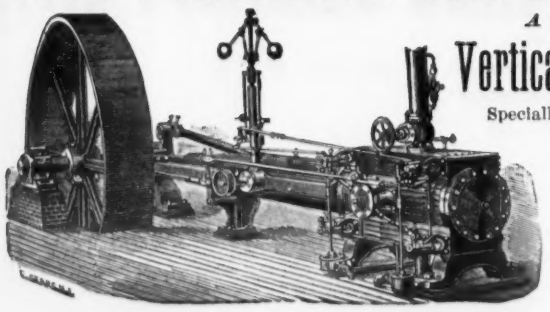

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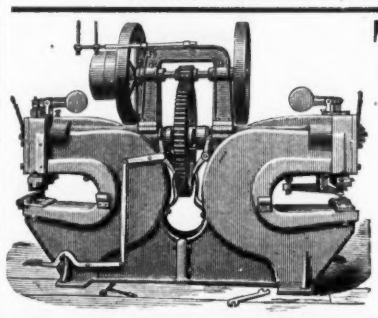

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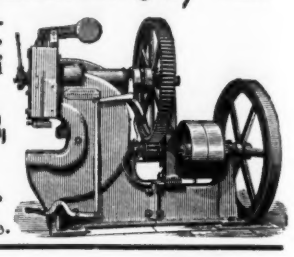

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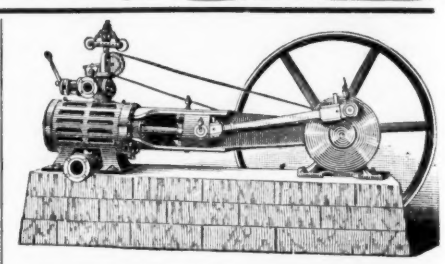

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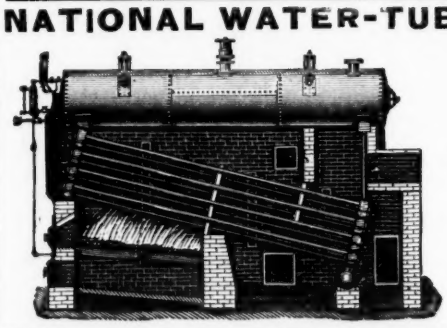

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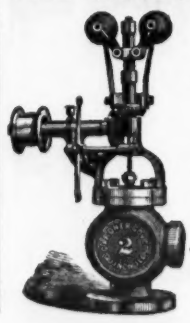

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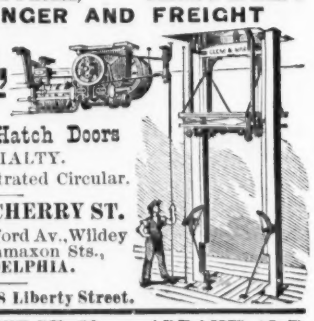

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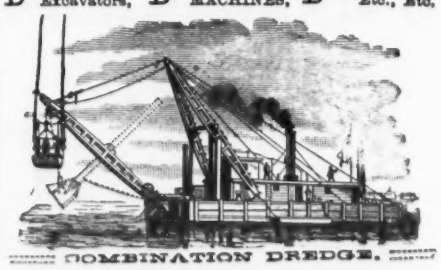

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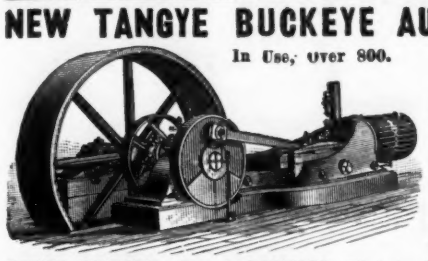

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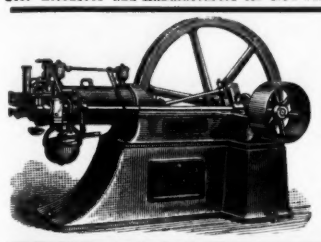

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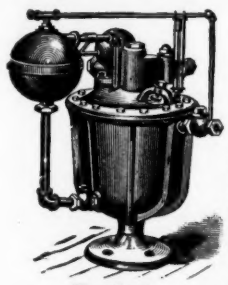

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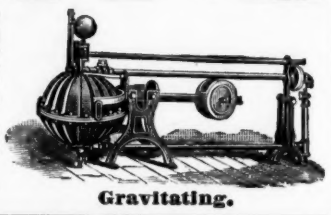

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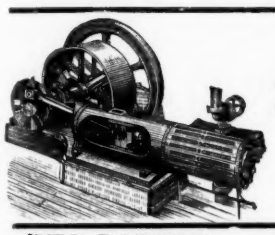

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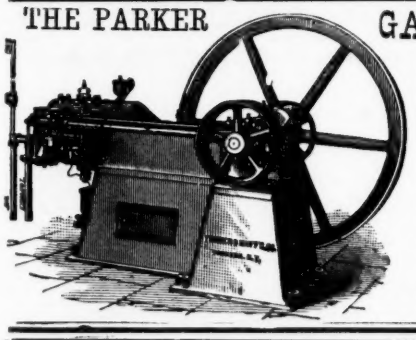

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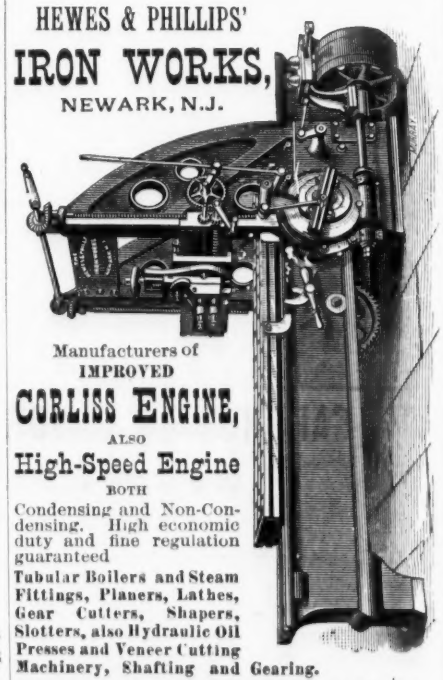

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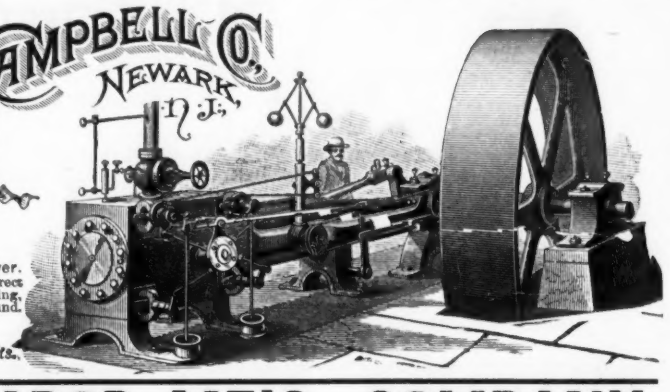

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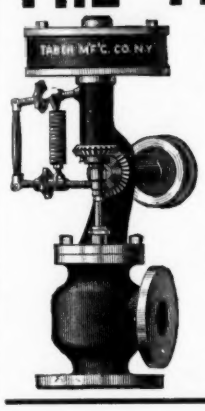

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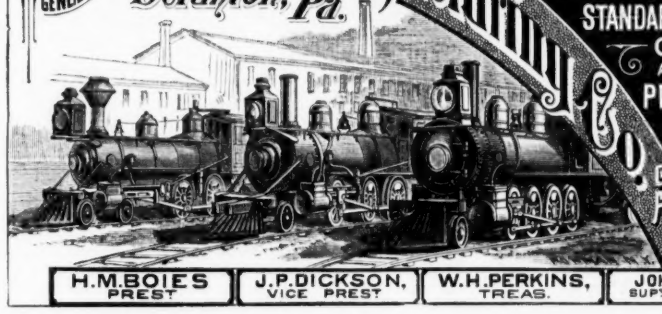

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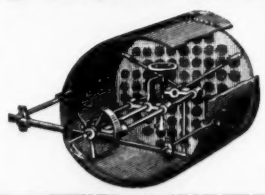

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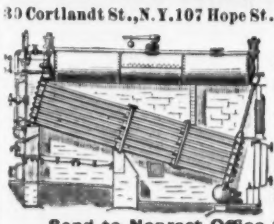

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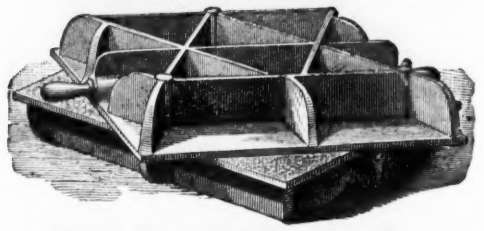

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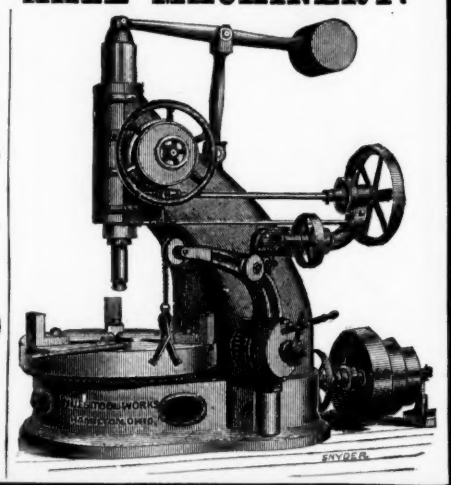

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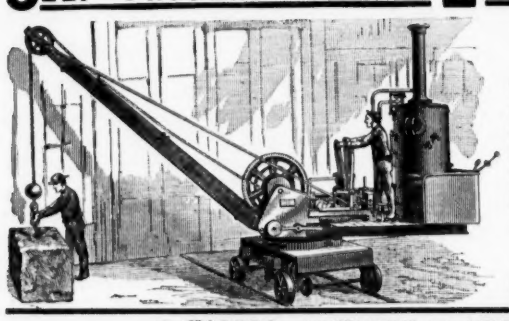

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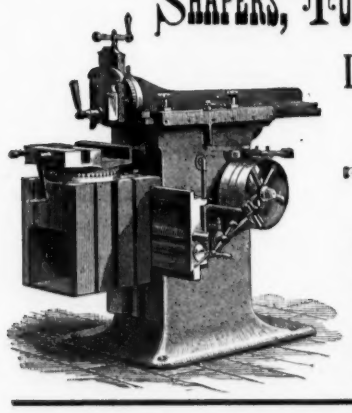

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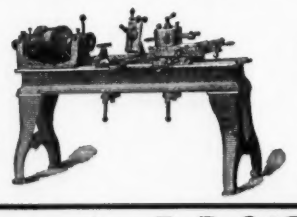

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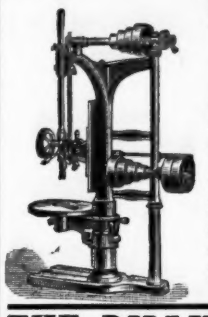

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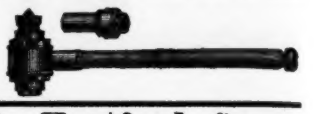

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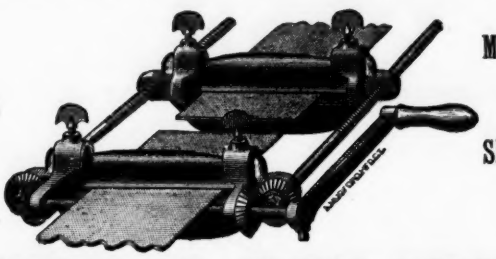

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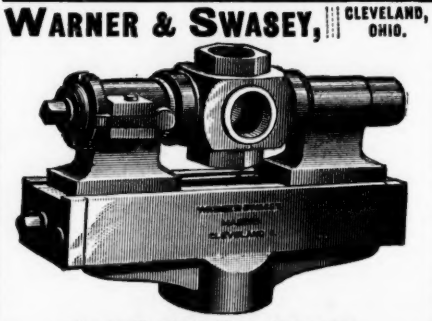

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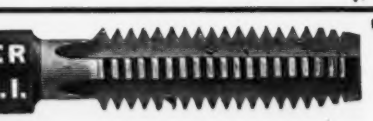

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